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THE INSTITUTION MEETING

A Review of the Proceedings

The Seventy-Second Annual General Meeting of The Institution of Gas Engineers, which commenced on Tuesday, June 4, was remarkable in many respects. In the first place, the number of acceptances for the Meeting constituted a record at 1,547, which surpasses the 1,500 strong at the First International Gas Congress held at the same meeting place, the Institution of Civil Engineers, in 1931. Writing of that Conference four years ago, we mentioned that the Great Hall of the Civils was full to overflowing. On June 4 last, when Mr. Valon Bennett, the President, rose to commence the first session he was faced by an audience sitting and standing and very obviously enthusiastic. One way and another there has been a good deal of commotion in the Gas Industry during the past twelve months, brought about not only by the severity of competition but by a real desire on the part of the Industry not to remain content with its tradition, good as this is, but to expand its business by adopting modern methods, not merely in the retort house but in every sphere of its activities. The new idea that the products of the Industry are made for one purpose—that they should be sold—found expression in the well-balanced programme of the Meeting, in which attention was properly devoted to the sales side of the Industry as well as to the manufacturing side. And this, remember, was a Meeting of The Institution of Gas Engineers. The new spirit is definitely a good one, in fact the only one for progress.

THE PRESIDENT—C. VALON BENNETT.

Mr. Bennett's first duty was to extend on behalf of the Institution a cordial welcome to everybody and particularly to those—and they were not a few—from overseas.

Mr. Alexander, the Secretary, announced the names of the overseas visitors. There were Messrs. A. J. Barr, Sydney; F. W. J. Belton, New Zealand; C. C. Challis, Sydney; R. C. Evans, Melbourne; John Irminger, Bergen; H. V. Mitchell, Victoria, Australia; F. L. Langford, Tasmania; J. K. Simpson, Shanghai; A. Stensaker, Bergen; H. E. Stone, Hong Kong; Herbert Wood, Sydney; J. P. Blackmore, Bombay; W. T. Jebb, Connecticut.

Then came announcement of messages of greeting from Herr Fritz Escher (immediate Past-President of the International Gas Union); President Young, Major Alexander Forward (Managing Director) and Mr. Kurwin R. Boyes (Secretary), of the American Gas Association; Mr. J. C. Dawson, President of the Canadian Gas Association; M. E. Welvaert, President, and the Secretary, of the Belgian Association of Gas Engineers; the Secretary of the Czechoslovakian Gas and Water Association; Mr. H. Hansen, President of the Danish Gas Works Association; the President and M. P. Mougin (General Secretary) of the French Gas Union; Herr F. Zur Nedden, Managing Director of the German Association of Gas and Water Engineers; the President of the Hungarian Gas Works Association; Herr H. Zollikofer, General Secretary of the Swiss Society of Gas and Water Engineers; Dr.-Ing. Michelangelo Bohm, of Milan; Herr H. Müller, Director of the Hamburg Gas Works; Dr.-Ing. Lempelius, of Berlin, who has retired from the office of Managing Director of the German Association of Gas and Water Engineers; Mr. J. H. Hultman, President of the Swedish Gas Works Association; and Mr. Swierczewski, of the Polish Gas Association.

The President then moved that the Annual Report for 1934-35 be taken as read—a motion which met with no comment. Again we can record an increase in Institution membership. At December 31 last the membership, at 1,525, showed an increase of 31 over the corresponding

figure for the previous year; and this figure of 1,525 must by now be considerably augmented.

A good deal of the report is, of course, concerned with what took place at the annual meeting in London a year ago and the autumn research meeting last November. Reference is made to the formation of the British Gas Federation in October, 1934, and to the work of the Joint Co-ordinating Committee and its Technical Sub-Committee in connection with the Gas Development Centres. An outline of the proceedings at the 2nd International Gas Conference in Zurich last September is given, and it is mentioned that Mr. Bennett has been elected a Vice-President of the International Gas Union. Among other matters briefly touched upon in the report are education and the Sir Arthur Duckham Memorial Fund. In regard to the former, a new edition of the Education Regulations has been issued, and it is stated that the entries for the 1935 Examinations show that the number of candidates for Certificates and Diplomas of the Institution is being maintained. The number of Centres having Approved Courses in Gas Subjects has been increased, particularly the number of Centres having Approved Courses in Gas Fitting.

The first "Arthur Duckham Research Award" is to be made this year, and it is estimated that the gross income of the Fund will be approximately £355 per annum.

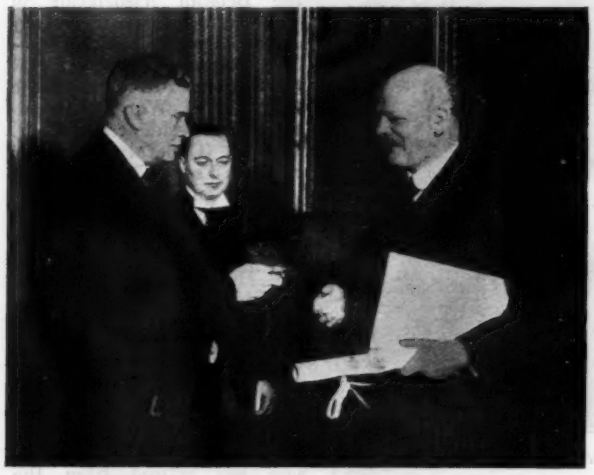
During 1934-35, 97 meetings of the Council and Committees of the Institution were held.

The resolution moving the adoption of the Annual Report and Accounts was seconded by Mr. Botley, of Hastings, following which the Meeting elected Mr. Roberts, of Hereford, and Mr. Nicholas, of Guildford, as Scrutineers of the ballots for the election of officers and to the various classes of membership of the Institution.

Presentation of Medals.

This brought us to the presentation of medals by Mr. Bennett. The first award was the Walton Clark Medal, with the Citation and Medal Certificate, to Mr. F. J. West, of Manchester. The award was made in consideration of Mr. West's "outstanding service to the Gas Industry in the sphere of improved scientific development of gas-works practice and technique and practical gas research as applied particularly to the carbonization of coal in vertical retorts, and for his work in the training and education of engineers and his success in promoting amicable relationships between employer and employed, all of which have been of substantial value to the Manufactured Gas Industry."

The Medal Day Meeting at the Franklin Institute actually took place on the 15th of May last, but Mr. West was unable to attend. Mr. Bennett said that he had read with great interest the report of the proceedings at that meeting, and he mentioned that the other recipients of medals were Professor Einstein and Sir Ambrose Fleming. Handing Mr. West the Medal the President said how proud The



The presentation of the Walton Clark Medal to Mr. F. J. West, by the President (Mr. C. Valon Bennett).

Institution of Gas Engineers was that the award had been made to one of its members.

Mr. West was greeted with great applause, and in addressing the meeting said he hoped that members of the Institution would regard the Medal as an honour conferred upon the Gas Industry. "The work which has been associated with my name," he said, "is primarily that of a group rather than that of an individual, and I like to believe that the award of this Medal is an expression of the goodwill and happy relationship which was furthered and cemented by the delegation from Great Britain to the United States in the autumn of 1933."

Captain J. Fraser Shaw went to the platform to receive, on behalf of himself and Dr. J. G. King, the Institution Gold Medal for their joint Paper on "Recent Experiments at the Fuel Research Station upon Products of Smokeless Fuel," read at the Meeting of the Institution last June.

The H. E. Jones London Medal was awarded to Mr. D. H.

The Franklin Institute.

Parkinson for his Paper on "Modernizing Small Gas Undertakings," presented at the same Meeting, and the recipient of the Institution Silver Medal was Mr. F. B. Richards for his Paper "Perspective in Carbonizing Costs," read at the autumn meeting of the Eastern Counties Gas Managers' Association last year. The final award, the Institution Bronze Medal, was made to Mr. H. D. Sullivan for his Paper on "Economic Considerations of Gas-Fired Central Heating" before the Western Junior Gas Association in December last.

A Products Industry.

At this stage of the proceedings the President rose to deliver his Presidential Address, which, in small compass, covers a great deal of ground and touches upon topics of vital interest to the Gas Industry at the present time and which will affect future policy. The fact is stressed by Mr. Bennett that the Gas Industry is a Products Industry —which fact the "JOURNAL" has been at great pains to emphasize. Attention is called to the increasing value of tar and its products of distillation, and of benzole recovery. The President leaves no one in doubt as to his opinion on the right policy in regard to the marketing of coke. We should market uniformly graded sizes to suit the requirements of the various domestic and industrial heating appliances, and apart from the matter of grading we must see to it that the coke delivered should be of uniform composition. "Solid smokeless fuel for the open firegrate," he observes, "deserves more attention than it is commonly given by our Industry. Much is admittedly being done by the installation of types of grate specially designed to burn the more combustible grades of coke, but there remains a wide public ready to welcome, at a reasonable price, a solid smokeless fuel which will burn without special attention in existing types of open grate. . . . The London and Counties Coke Association has met with great success and . . . I suggest further efforts should be made to see if other Associations, with benefits similar to those attaching to the one I have referred to, cannot be constituted."

Holding Companies.

What the President has to say about holding companies —a "symptom of all contemporary economic evolutions" —is very much to the point. It cannot yet be determined, he remarks, if all the expectations of those connected with this development in the Gas Industry will be fulfilled, nor if the fears will be realized of those who believe that the movement is not a wise and healthy one. It can, however, be said with certainty that, unless these holding companies are operated in conformity with the experience and tradition of the Industry and its obligations as a public utility, they cannot attract a full measure of support. Some gas undertakings would benefit by being allied to larger concerns, but the view is held by the vast majority that any control must be of the "finger-tip" type. For instance, the benefits of the "big brother" can and will be entirely nullified if local conditions are ignored and if the real pride

which provincial towns have in the local Gas Company is destroyed by the Undertaking losing its local identity. Public utility undertakings must avoid the ever-present danger of becoming bureaucratic, for their success or failure depends almost entirely upon the goodwill of a localized body of consumers, the apparent beneficiaries of extreme competition.

Mr. Bennett mentions the real fear which the development of the holding company principle is causing many

THE NEW PRESIDENT.

Col. W. M. CARR, O.B.E., T.D.

Col. Carr was born in the year 1886, and was educated at Manchester University, Owens College, where he took the Engineering Certificate. He was afterwards pupil under the late Lt.-Col. J. Mitchell Moncrieff, C.B.E., Civil Engineer, of Newcastle-upon-Tyne, and was engaged in bridge and dock construction work. He spent a year subsequently in Germany on gas-works and engineering works. In 1907 he joined his father, the late Mr. Isaac Carr, M.Inst.C.E., in his gas and water consulting engineering practice, and assisted in the design and construction of a number of new gas-works, including Thornton Cleveleys, Frizington, Withnell, and Fazakerley for the Liverpool Corporation, and in practice generally. In 1911, in addition to consulting work, Col. Carr became Engineer and Manager to the Ormskirk District Gas Company, and in 1922 Engineer and General Manager to the Stretford and District Gas Board. He has served for twenty years in the Territorial Army in the 55th (West Lancashire) Divisional Engineers, R.E., being with this unit in France during the war. He also served throughout the North Russian campaign. He was transferred to the Territorial Army Reserve in February last after commanding the regiment for eight years. Col. Carr was appointed Honorary Colonel of the 55th (West Lancashire) Divisional Engineers, Territorial Army, in April, 1934. He received the rank of Brevet-Colonel in 1930, and was awarded the Territorial Decoration in 1929, and subsequently the O.B.E. (Military Division).

gas engineers and managers, who are naturally concerned as to their future under a new régime. "As at present generally administered, the Gas Industry is one, and many officials feel that neither the Industry in general, the company they serve, nor themselves should suffer merely by reason of financial opportunism."

On the question of gas charges the President urges all undertakings to take advantage of the new legislation, which does offer a large measure of freedom. It was natural, too, that Mr. Bennett should comment on the formation of the British Gas Federation, which, he is sure, is destined to consolidate the position and increase the prestige of the Industry. "Many feel a little restive and critical," he remarks, "because the Federation does not appear to have been very active. Let me assure them that it is at work. I say this because I am anxious the idea should not get abroad that it is doing nothing. It was a great step forward to enable the five National Bodies to agree to and become members of one organization and, that being so, it is essential no false move be made which might result in irreparable damage being done. I have no fear as to the ultimate success and power of the British Gas Federation."

Prospect.

Having mentioned that one Company alone fixed 280,000 cooking stoves last year—equal to one for every two minutes of the day and night throughout the twelve months—Mr. Bennett asked his audience to consider how activity in the matter of installing additional appliances must affect the future. "It means," he said, "in many instances that, when we have a return to greater prosperity and normal seasons, numbers of undertakings may find themselves in the unenviable position of not having sufficient manufacturing and storage plant. With consumption for 1934 not in excess of that for 1933, it is difficult to expect Boards or Committees to incur large expenditure to cover future requirements. That appears to me to be a very short-sighted policy, and those of us who advise the administrators of undertakings should emphasize that the cost of plant can hardly be lower than it is at present, that money is cheap, and that now is the time to put work in hand and thus safeguard the future. With the return to national prosperity, money must become dearer and, if our extensions are to be put off until then, a higher price must be paid, with the result that, however much we may desire to sell gas at a low price, we shall not be able to do so as easily as will be the case if we embark upon capital expenditure now."

We have mentioned the President's views on coke marketing. At the close of his Address Mr. Bennett quotes from a Paper before the Institution given by his grandfather 58 years ago. Had the advice offered on coke sales in that Paper been followed, the Industry would have been in a more prosperous condition to-day.

Vote of Thanks.

A vote of thanks to the President for his Address was proposed by Mr. F. J. West and seconded by Mr. Campbell, of Margate. Mr. West said he thought all would agree that Mr. Bennett had given them an accurate portrayal of many of the leading problems of the Gas Industry, and that he had struck a note of confidence for the future. It was, he said, an Address which should stimulate and encourage to greater achievements all those engaged in the Industry.

Mr. Campbell paid tribute not only to the President's engineering skill as exemplified by the work he has carried out at Rochester, but also to his ability as an administrator.

The vote of thanks was supported by Sir David Milne-Watson, who spoke as Chairman of the Rochester Company. Sir David said that what interested him most in an Address of first-rate interest throughout was Mr. Bennett's reference

THE SENIOR VICE-PRESIDENT.

STEPHEN LACEY, B.Sc., M.Inst.C.E.

Mr. Lacey obtained his engineering training at the City and Guilds College, South Kensington, and after five years with Messrs. G. H. Hill & Sons, Consulting Engineers, entered the service of the Gas Light and Coke Company in 1911 as assistant to the then Distributing Engineer, Mr. H. S. Reeson, whom he succeeded in 1918. In 1923 he was appointed Deputy to Sir Francis Goodenough, devoting special attention to the technical activities of the Departments which, in 1926, were brought together in Watson House. On the retirement of Sir Francis in 1932, Mr. Lacey became Controller of Gas Sales.

to the national organizations of the Gas Industry. "It is," he said, "of the utmost importance that we should all give hearty support to our organizations. We are now a united family, under the British Gas Federation; its formation, I am sure, was a step long overdue, and now that that body has been brought into existence it gives us a much stronger front with which to meet the difficulties which face us. But this strong front cannot be maintained without the necessary funds to do it, and I take this oppor-

tunity of endorsing what our President has said, that everybody in the Gas Industry in this country should support the national organizations by providing the necessary funds."

Testing of Appliances.

The first Paper to be presented and discussed was that by Mr. Stephen Lacey and Mr. Masterman on "National Policies Governing the Testing of Appliances," the very title of which is indicative of its importance. The authors point out that Great Britain is exceptional among the larger gas producing countries of the world in having no official and recognized system of test for ensuring the safety and efficiency of gas appliances. On the other hand, they draw attention to the effective technical supervision of gas appliance design and installation by manufacturers and undertakings which in practice exists in this country and which has led, generally speaking, to the creation of high standards of safety and efficiency. That is not to say that nothing remains to be done. On the contrary, the development and extension of the Gas Industry will depend to a great extent upon what further steps are taken to improve the construction and installation of gas appliances and to ensure their satisfactory performance in actual use. The increasing extent to which the Gas Industry is likely in the future to encourage builders and merchants to handle gas appliances may, perhaps, especially require safeguarding.

THE JUNIOR VICE-PRESIDENT.

H. C. SMITH.

Mr. Smith received his training in gas engineering with the City of Birmingham Gas Department. He was appointed Works Superintendent at the Swan Village Works in 1912, and, with the exception of the war period (during which he served in the Royal Field Artillery), occupied this position until 1920, when he was appointed Works Superintendent at the Tottenham Works. He became Chief Engineer at Tottenham in 1922. He was elected an associate member of the Institution of Civil Engineers in 1925, and a full member in 1928. Mr. Smith is Chairman of the Board of Examiners of The Institution of Gas Engineers.

The Paper reviews the organization and operation of the systems in other countries, ranging from the centralized and very rigid system of the American Gas Association to the more flexible and voluntary systems of Germany, France, and Switzerland, which tend to be the models for other European countries. The origin of these various systems is usually to be found in the existence, prior to such organization, of unsatisfactory standards of gas appliance design, construction, or installation.

Examination of the technical standards accepted under these various systems shows them not to be in advance of the unwritten standards which operate in Great Britain. A scheme of specification of standards, the authors state, may prejudice progress and may even cause design to work down to a minimum limit, while reliance on certification may diminish the sense of responsibility of the undertakings to the public and so diminish the chief force which can reduce the statistically rare gas accident to vanishing point.

The authors maintain that there is room for more co-operation throughout the Gas Industry on appliance standards and results of tests, but that a readier exchange of information would carry with it a more systematic organization of technique regarding all gas utilization problems. They ask for a framework organization to facilitate exchange and free discussion of technical information, co-operation and mutual assistance in research, testing, and statistical enquiry, and co-ordination of technical effort where contact is made with other industries or research associations. Then, within a suitable framework, co-operation in the testing of gas appliances could readily be achieved without introducing the rigidity associated with excessive centralization.

Proposed National Policy.

It is suggested that registers or panels of gas utilization personnel be created by The Institution of Gas Engineers, membership being in no way conditional upon membership of the Institution itself. Four registers are proposed, representative of Industrial, Domestic, Illumination, and Utilization Research technique. The qualifications for registration would require much consideration to ensure an adequate but not too exclusive a standard of technical competence. Membership of the first three registers should be on as broad a basis as possible consistent with some degree of specialized experience in the nominated technique and might easily run into hundreds. Membership of the Utilization Research Register should require definite experience in laboratory research work but should not necessarily be confined to personnel belonging to the Gas Industry. Nomination of individuals as members of Committees dealing with utilization problems could conveniently be confined to personnel whose names were on the appropriate register. The members of each of the four registers should have opportunity to meet at least once a year for general discussions, reading Papers, &c.—possibly as sections operating during the meetings of The Institution of Gas Engineers, on the lines of the meetings of the American Gas Association.

The type of decentralized organization which now operates in connection with industrial problems is proposed for the purpose of linking together the personnel in each of the other three specialist panels, so that in addition to an Industrial Technical Committee there would also be a Domestic Technical Committee, an Illumination Technical Committee, and a Utilization Research Committee. The first three of these would be constituted on area representation from the several Technical Centres which could be set up on similar lines to the Industrial Centres. In most cases the subscribing undertakings to the Industrial Centre would presumably become subscribing undertakings to the Domestic and Illumination Centres, which could be conveniently under the same control. Each area would thus be self-supporting in utilization technique subject to co-operation and co-ordination with and through the respective Technical Committees on which its representatives would meet representatives of other areas.

The duties of the Technical Committees would be in the direction of technical development, co-ordination of effort and as a channel through which technical information could be distributed through the Area Centres to the subscribing undertakings. The duties and constitution of the Utilization Research Committee would require different treatment, the membership being based not on area representation—which would be irrelevant—but on the basis of research responsibility or academic distinction. And the authors suggest that co-ordination of technical abstracting and control of a technical library could conveniently be placed under this Committee.

An important factor in the success of any national scheme, it is emphasized, is the ready co-operation of the manufacturers. This must be encouraged.

As for the testing of appliances, this "requires to be organized on the simplest possible basis, and overloading by committees or strangulation by excessive system must be avoided." The safety aspect of appliances is all-important and requires a minimum of specification; and this aspect could be controlled by the use of a certification Trade Mark. The authors suggest, however, that this mark should not be used as a selling point, since it would have no relation to the capability of the appliance satisfactorily fulfilling its purpose other than being merely safe.

Dr. Hartley's Criticism.

As we anticipated, the Paper evoked a very keen discussion. As a matter of fact there were many more who would have taken part in the oral discussion had time allowed. The first speaker was Mr. H. C. Smith, of Tottenham, who said there is no question of the Institution wishing to keep from its ranks those who may be qualified technically in other directions but not as gas engineers, and the Institution should welcome as Associates all those who are so qualified. This matter was the theme of the remarks by Dr. Harold Hartley, who pointed out that

THE 1934 INSTITUTION MEDALLISTS

Dr. J. G. KING, B.Sc., F.I.C.

Dr. King was educated at the Royal Technical College, Glasgow, graduating in chemistry, in 1912, with distinction. During this year he also obtained the Associateship of the Institute of Chemistry. In 1912, he was appointed Assistant to Prof. T. Gray in the Technical Chemistry Department of the College, and remained there for two academic years. In 1914 he joined the staff of Nobel's Explosives Company at their Ardeer Factory, rising during the next few years to Departmental Superintendent. During 1919 he was appointed Research Chemist at the Fuel Research Station at Greenwich, and, about two years later, became Chief Chemist. He is the author of a large number of scientific papers upon various aspects of fuel technology.

Capt. J. FRASER SHAW, R.N. (Ret.).

Capt. Shaw entered the Royal Naval Engineering College at Keyham at the age of 15, and was appointed Probationary Assistant Engineer in the Royal Navy five years later. In 1918 he was lent from the Admiralty as Assistant Controller to the Mineral Oil Production Department of the Ministry of Munitions, and in 1919 to the Department of Scientific and Industrial Research as Chief Engineer of the Fuel Research Station. Having served in various ranks in the engineering branch of the Royal Navy, Capt. Shaw retired as Engineer Commander in 1922, and was appointed Chief Engineer under the Department of Scientific and Industrial Research.

F. B. RICHARDS, M.B.E., M.Inst.C.E., M.I.Mech.E.

Mr. Francis B. Richards was apprenticed to Wm. White & Sons, of Cowes, and was also a pupil under Lieut.-Col. H. W. Woodall, Engineer and General Manager of the Bournemouth Gas and Water Company. He subsequently became Assistant to the late Sir Arthur Duckham in connection with the design, construction, and operation of the Woodall-Duckham system of continuous vertical retorts. During the war Mr. Richards was Assistant Superintendent of the Government Rolling Mills, Woolston, Hants. In 1923 he was appointed a Director of the Woodall-Duckham Companies, Joint Managing Director in 1930, and Chairman (in succession to Sir Arthur Duckham) in 1932. He is a Member of Council and Chairman of No. 1. Section of the Society of British Gas Industries.

The Awards were as follows :—

Gold Medal	Dr. J. G. King and Capt. J. Fraser Shaw.
Silver Medal	Mr. F. B. Richards.
H. E. Jones London Medal . .	Mr. D. B. Parkinson.
Bronze Medal	Mr. H. D. Sullivan.

D. B. PARKINSON, M.A.

Mr. Parkinson was educated at Birchington and Oundle. In 1919 he went to Cambridge and took a degree there in 1922. He gained experience with the Compagnie pour le Fabrication des Compteurs, Paris, and was a pupil engineer of the Gas Light and Coke Company at Beckton, Fulham, and the Distribution Department. In 1927, Mr. Parkinson was appointed Assistant Engineer at their Nine Elms Works, and two years later he became Engineer at the Chief Office of the British Gas Light Company.

Mr. H. D. Sullivan entered the Gas Industry in 1924, when he joined the Distribution Department of the Lancaster Corporation Gas Department under Mr. G. Dixon, who is, of course, now at Nottingham. In June, 1933, Mr. Sullivan was appointed Assistant Sales and Technical Superintendent to the Plymouth and Stonehouse Gas Light and Coke Company under Mr. J. H. Dyde. He gained a First Class Diploma in Gas Supply in June, 1934, the only Diploma awarded during that year.

H. D. SULLIVAN.

the framing of tests of gas appliances necessitates calling into consultation chemists and physicists who have the requisite knowledge and experience, and he believes that their growing importance to the Industry involves fuller recognition than has yet been given. As things exist at present there is a very great gap in the technical organization of the Gas Industry, which suffers because there is no body which can claim to represent it on all its technical phases. The Industry shows, he went on, scant appreciation of the scientifically trained men in its service. We are sitting in a series of water-tight compartments—a state of affairs which must be altered. Dr. Hartley feels that the Authors' suggestions are quite inadequate owing to their endeavour to link the proposed developments with an existing organization. Membership of the proposed panels would hardly appeal to eminent scientific men outside the Industry. "I feel," he said, "that you will not obtain the best services, even from the chemists and physicists within the Industry, merely by appointing them to panels of the Institution or any other body." They would not be admitted to the parent body as a right, although they would be asked to serve on the panels because they happened to be of use to the Industry. Also the technical staffs of firms engaged in the manufacture of gas-making plant or of gas-consuming appliances should only be expected to co-operate fully with others in the Industry on an equal footing. Dr. Hartley suggested that we are in need of an all-embracing Gas Institute the only qualification necessary for membership of which should be interest in the technical progress and developments of the Gas Industry and full-time service within its bounds. Let us have no nonsense about professional merit. Let the membership be open to all and sundry who have a technical job to do and ask from them only payment of a small fee, as it is desirable that membership should number many thousands. Dr. Hartley emphasized that his proposal is that this Gas Institute should be concerned solely with technical matters, and should not interest itself in questions of policy and other special problems which are better looked after as at present by existing organizations. He hopes the proposed Institute may be brought within the framework of the British Gas Federation, and that it will be established in this year of Jubilee.

Dr. C. M. Walter spoke of the desirability of discriminating between safety to the user and performance of the appliance. It is easy to certify an appliance on its ability to pass a safety test, but the question of certifying its performance is quite another matter. He doubts whether the manufacturer should use the test mark on his own responsibility. The badging should be left to an authoritative independent body.

It is the opinion of Mr. T. P. Ridley that the certification system would not be satisfactory in this country because appliances which conform to the minimum requirements would not in many cases be of sufficiently high standard for the progressive undertakings to supply to the public—quite apart from the cost of such an organization. On the other hand, there should be more agreement as to methods of testing.

Dr. B. Friedman suggested that a certification trade mark would be of no avail unless the Gas Industry is invested with power to withhold the supply of gas unless satisfied with regard to gas appliances, installation, flue, and so on, and has the authority to enforce maintenance. The fact that gas undertakings themselves handle such a large proportion of the appliances installed is in effect equivalent to a certification trade mark without introducing the drawbacks of a visible mark. Nor is Dr. Friedman in favour of marking the safe gas rate of the appliance. Such a marking would create confusion in the mind of the public and of the trade, both being insufficiently conversant with the object of such marking.

Mr. Madden called attention to the latent defects of apparatus which may develop during use. An appliance may be perfectly good when tested in the laboratory, but such defects may appear after it has been in use for some time. Another point made by Mr. Madden is that a technical test should not be regarded as the last word. There is also the woman's point of view, and there is need for greater co-operation between lady demonstrators and technicians.

During the course of the few remarks which brought the discussion to a close, Mr. Percy Goode, of the British Standards Institution, said he was glad that the Authors referred to the need for the standards to be written down so that they should not merely be matters of discretion. As for certification marks for gas appliances, he does not believe that one could confine requirements solely to safety. It is permanent safety rather than just safety which is wanted, and the requirements should be arrived at by agreement between manufacturers, users, and the scientific and technical people; and in this regard Mr. Goode referred to Disraeli's definition of a practical man as "one who practises the errors of his forefathers."

Reconstruction at Nottingham.

The contribution which claimed first attention on Tuesday afternoon was by Mr. George Dixon, of Nottingham, who gave an account of the reconstruction of the manufacturing and distribution plant of his Undertaking carried out since 1932. In his Paper Mr. Dixon sets out the various reasons which led to the decision to reconstruct the vertical retort plant at the Basford Works to give 6 million cu.ft. of gas of 475 B.Th.U. per cu.ft., and to erect vertical plant at the Eastcroft Station, which had been closed down, to give 3 million cu.ft. a day. The chief characteristic of the Paper is the wealth of detailed information on costs—which information should prove of the greatest assistance to other engineers who may be contemplating reconstruction work, and will certainly prove of interest to all engineers. Nottingham has enjoyed an excellent reputation for its coke, which is suitable alike for domestic and industrial purposes. It is free burning and easily ignitable and is quite suitable for use in open grates. The financial return from coke represents 48% of the cost of the coal into bunkers, so that it was desirable that the choice of carbonizing plant should be such as would enable this market to be retained. The ultimate decision was to install upwardly heated Woodall-Duckham continuous vertical retorts.

The site at Eastcroft is exceedingly limited, and the capacity of plant per unit area was of the greatest importance. Mr. Dixon mentions the figures given by Mr. Thomas Hardie in 1927 relating to the cubic feet of gas made per 24 hours per square foot of retort house: Horizontal retorts, 267·1; continuous vertical retorts, 531·2. Since that time much progress has been made with large section retorts, and in the case of Eastcroft, even though there are two separate benches of vertical retorts, a plant with a capacity of 3½ million cu.ft. of gas per day is accommodated on a plan area of 4,126 sq. ft., giving an output of 800 cu.ft. per sq. ft. of ground space. In his Institution Paper in 1933 Mr. R. W. Hunter gave the following comparative figures for the capital cost of various types of carbonizing plant: Coke ovens £279 per ton of coal carbonized per day; intermittent verticals, £262; horizontals, £260; continuous verticals, £249. Mr. Dixon states that the capital costs of the carbonizing plant at Eastcroft, including waste heat boilers, worked out at £273 per ton; this figure including the provision of a retort house of modern design and ample area.

Nottingham coke requires considerable care in handling, and for this reason a Woodall-Duckham "Undulo" rubber belt screen, combined with vibrating scalper and debreezing screens, was installed; and the author speaks highly of the efficiency of this screening unit, among the attractive features of which are the small amount of breeze formed in screening, the low power requirements, and the absence of vibration noise.

Mr. Dixon also gives a full description of the reconstruction of the Distribution Shops of the Nottingham Gas Department, paying particular attention to the cooker renovation plant. The cost of the whole reconstruction, which has enabled the Undertaking to give good service and "under conditions for our employees that are in keeping with the importance of the Department," was £7,559; and the new stove renovation plant has resulted in a reduction in cost per cooker from 14s. 7d. to 7s. 1d. The output has been increased by 54%, and the saving in labour alone is equivalent to £2,800 per annum.

Coke Oven Gas Supplies.

The discussion was opened by Mr. Gibson, of Liverpool, who said that many would disagree with the Author's view that the risk of failure of coke oven gas supplies is not greater than the risk of similar failure from gas-works. He pointed out that the men employed on coke ovens belonged to the same Union as the coal miners, and would be affected to the same extent in the event of a coal dispute. Here is good reason why users of coke ovens should make adequate provision against possible stoppage. On the same question Mr. Haynes, of Rotherham, maintained that modern coke oven supplies are as reliable as those from any gas undertaking's own retort house, and when several undertakings draw gas from one coke oven plant or from the same group of coke ovens, a local gas grid is a practicable possibility. The development of such gas grids, he said, should be more positively fostered and encouraged by the national gas organizations. He mentioned that agreements recently made in the Rotherham area provide for the summer quantity of coke oven gas taken to be two-thirds of the winter quantity.

Mr. Clegg, of Southport, said that there is no doubt that modern coke oven practice will supply us with gas introducing no greater degree of danger of lack of supply than in regard to gas produced at a gas-works. In any case it is necessary to make such provisions in the agree-

nts as will provide for alternative labour or alternative thods of production of gas. On the other hand, the int should be borne in mind that coke ovens are being ected simply to supply gas undertakings with gas, which ll mean greater competition for the Gas Industry in the ke market.

Referring to the moisture content (6·26%) of the ke produced at Nottingham, Mr. Gibson said that from s experience at Liverpool this is too high for easy ignitbility in the domestic grate, and he suggested that there ould be no difficulty in obtaining under 2% in the lant installed at Nottingham. On the question of oker cleaning, he remarked that after lengthy experience t Liverpool of the caustic soda washing process and of nd or shot blasting, the conclusion had been reached hat these processes are objectionable and in most cases nnecessary. Incineration followed by cleaning with wire rushes either machine or hand operated is preferable. Ir. Gibson gave particulars of his incineration plant, hich is capable of a greater output than that at Nottingham and also has a lower gas consumption per cooker reated.

The Sledge Hammer Policy.

A sledge hammer policy for the scrapping of old, black, and inefficient cookers was strongly advocated by Mr. Shaw, of Buxton, who expressed his belief in the cooker oven with a single burner and bottom flue outlet. Two-thirds of the cookers in Buxton are of this type, the remaining thousand being old ones, and maintenance and cleaning of this one-third minority accounts for 90% of his cooker service maintenance cost. If, said Mr. Shaw, the results of Mr. Dixon's efficiency in designing and laying down plant to renovate cookers so cheaply is going to result in his retaining old two-burner top flue outlet ovens in his district longer than otherwise it will do him and his Department a great disservice. Mr. Shaw referred to competition from furnace coke, and contended that instead of attempting to meet like with like, gas undertakings should consider another method of meeting competition where the financial odds are not all on the other side. His idea is to produce a lighter and more readily ignitable and free-burning coke.

Mr. J. Mitchell, of Leicester, spoke of unwelcome "visitors" which apparently are capable of withstanding high temperatures and can find a happy home in the slag wool of a cooker lining. If experience proves that incineration of the cooker destroys both living and unborn "visitors." then the elimination of the necessity of dismantling stoves will greatly reduce the cost of their renovation.

Mr. Crowther, of Salford, said he would be interested to learn Mr. Dixon's reasons for excluding from consideration intermittent vertical retorts, which would have yielded a denser coke and yet would have fitted in with the site requirements at the Eastcroft Works. He also queried how much longer Nottingham could rely on buying its coals at the price indicated in the Paper.

Several speakers touched upon the design of gas-works structures to make them more pleasing architecturally. Mr. Gibson queried whether cathedral-like structures are necessarily appropriate to gas-works, but the general opinion was that a good-looking building which will enhance the prestige of the Industry and encourage the workmen to take a greater pride in their undertaking is more than worth the extra cost entailed.

A tribute to Mr. Dixon's skill was paid by Mr. John Wilkinson, who, of course, was Mr. Dixon's predecessor at Nottingham. Mr. Wilkinson spoke of the remarkable advances in vertical retort practice as exemplified at Nottingham.

"The Gas Account."

The final Paper on Tuesday afternoon was "The Gas Account," by Mr. W. B. McLusky, of Halifax, whose pioneer work on the matter of attractive tariffs for gas is universally recognized. The Paper commences with an illuminating analysis of the costs and working conditions of eight undertakings in order to illustrate the various combinations of elements which influence the price of gas. The results are representative of the cost of manufacture and supply of gas in this country, for the undertakings considered comprise large towns with a small consumption of gas per consumer, and small towns with a large consumption of gas per consumer; large towns with large responsibilities, accompanied by a large consumption of gas per consumer; large towns with equally heavy, if not greater, responsibilities, accompanied by only a moderate consumption of gas per consumer; smaller towns with relatively large capital commitments and a large consumption of gas per consumer; small towns with large capital commitments and only a small consumption of gas per consumer. There is also included an undertaking in which the cost of production is high, although the capital commitments are low and suitable coals of exceptionally high quality and moderate price are within easy reach and no particular disability is apparent as regards the disposal of residual products. The opportunities for the sale of gas in the areas referred to are examined, and it is shown that the consumption of gas per consumer per hour is still low, generally, in this country.

Mr. McLusky passes on to deal with the charges and regulations of the Halifax gas supply, setting out the six attractive scales in operation, and pointing out that the consumer's choice is limited to the block scale and the multiple tariff. He shows that the block scale is more advantageous than the step scale, and that as a business getter the multiple tariff wins. In regard to the block tariff, he suggests that it would be much better to quote gas prices at so much per unit of 4,000 B.Th.U., rather than at so much per 1,000 cu.ft. A halfpenny per unit, he believes, has a much greater sales appeal than, say, 4s. 2d. per 1,000 cu.ft., or an equivalent price per therm, for the first block. But a scale that enables the consumer to contract for the payment of a quarterly service-rental charge, independently of the volume of gas consumed, is conducive to pleasant business relations and the extension of the use of gas. The consumer who adopts the multiple tariff anticipates the service-rental charge. This is budgetted for, and, the commodity charge being low, any variation in the volume of gas consumed, owing to vagaries in the weather or other cause, is less onerous.

THE SECRETARY.

J. R. W. ALEXANDER, M.A., LL.B., F.C.I.S.

The examples given by Mr. McLusky of increased business resulting from the operation of multiple tariffs in Halifax should provide encouragement to other undertakings to adopt similar methods. At Halifax the service-rental charge is based on the floor area of the living and reception rooms, and the author points out that in the multiple tariff "the meter is used for its legitimate purpose, the measurement of gas. No consumer . . . should be obliged to pay 'overhead' charges 'as per meter index.'"

Proposed National Gas Board.

Mr. McLusky concludes his Paper by stating that the statutes governing the supply of public utilities are in urgent need of reform. In electricity supply, the municipal and company undertakings enjoy an equal measure of freedom. In gas supply, there are serious and hampering restrictions, and these restrictions vary as between municipal and company undertakings. The Gas Industry is entitled to the freedom extended to electricity supply undertakings. He maintains that the process necessary to obtain sanction to regulate the basis upon which the price of gas is fixed could be simplified. This is a domestic question, and one which could be settled at a round table comprising the interests concerned, just as questions concerning wages and conditions of labour are settled by the Industrial Council. The Industrial Council, as at present constitued, could, with the addition of consumers' representatives, appointed by the Board of Trade, deal impartially and satisfactorily with all questions affecting the price of gas. He suggests that the consumers' representatives might well be chosen,

as parliamentary committees are chosen, from the members of Parliament who have had experience in local government. Thus would be constituted a "National Gas Board."

A Lively Discussion.

Mr. Botley, who opened the discussion, said that Mr. McLusky's Paper showed that tariffs which suit one place by no means necessarily suit another. He had considered what would happen at Hastings if he followed the example of Halifax. Taking the same figures as were taken at Halifax last year he would have had a deficit of over £28,000, to which, later in the discussion, Colonel Carr suggested that Mr. Botley was adopting a wrong attitude towards the problem. He should first assess the additional load he might gain from the application of the tariff, and to make his deduction on the assumption that the tariff would be of no benefit was definitely wrong. Mr. Botley gave illuminating figures relating to the Hastings electricity undertaking. From the latest available statistics he found that 79% of the output was sold at a figure less than the self-supporting cost, and that from 13% of their output they obtained no less than 42% of their revenue.

In regard to the gas unit Mr. Haynes said that though the appeal was a strong one, experience in Rotherham indicates that what may appear straightforward to the engineer and the salesman is received very cautiously by the consumer. Mr. Ridley does not agree with charging by units instead of by therms. He thinks that to make the change will only cause confusion in the minds of the public. He mentioned that in one known case the gas tariff would not show a reduction until 25,000 units had been consumed, while the electrical competitor in the same district advertises in his tariff for the same purpose that the consumer will obtain reduction after consuming 200 units. In another known case the figures are 750 units and 32 units respectively.

"A Hybrid Tribunal."

Mr. Haynes asked how we could picture a National Gas Board as envisaged by Mr. McLusky, while Mr. George Evetts was much more critical in his remarks. He very much hopes that the Industry will not drag in such a hybrid tribunal as Mr. McLusky suggests, and he trusted that it would not go forward as representing the consensus of opinion of the Institution that Mr. McLusky's suggestion is the right way of settling the intricate problem of gas pricing. Mr. Evetts made a plea for greater simplicity in evolving scales of gas charges. It may, indeed, soon be found necessary to appoint a committee to eliminate the many variations and to get back to comparative simplicity. This does not mean the flat rate is to be advocated. It is dead, or, if not, should be killed without delay. Having subjected Mr. McLusky's scales to critical analysis, Mr. Evetts concluded his remarks by expressing the wish that the author would reconsider the matter and try to arrive at a simple scale of charges.

The virtue of simplicity was also stressed by Colonel Carr, who does not agree with grading the demand charges on the basis of floor area, room area, or assessable value. The demand charge, he said, must be based on the standing charge to the undertaking, and in formulating any tariff care should be taken to differentiate between domestic and large industrial consumers.

As a staunch advocate of attractive gas prices, Mr. Charles Ingham, of Brighouse, observed that generally speaking it costs us about 4d. per therm to supply additional demands for gas and we charge in round figures about 8d. a therm—a sheer 100% profit on additional business—and this is not the way to obtain the additional business per consumer we need if we are to prosper. The Brighouse scheme which he outlined is certainly most interesting, and with his tariffs he can get down to a price which is almost competitive with coal for continuous use.

Mr. Curtis, of Macclesfield, is not enamoured of two-part tariffs. If a two-part tariff is highly successful, he said, it may be found that the many small consumers are subsidizing those on the tariff scheme. He contends that the adoption of a two-part tariff tends to make summer and winter loads more divergent, in which case, unless there is surplus plant, it would necessitate further capital expenditure to accommodate the excessive peak load and for which there would be no corresponding allowance made in the commodity charge.

Mr. Ridley agrees with Mr. McLusky on the principle of grading tariffs for domestic consumers on a room basis, but he prefers grading on the number of rooms. He also prefers grading blocks of gas to grading service charges for domestic consumers, and in his experience the payment of a service charge is not more conducive to pleasant relations than the block rate.

Election of Officers.

Following the discussion the President announced the results of the election of officers and to the various classes of membership of the Institution.

The Honorary Members elected included Dr. A. G. Glasgow, the Rt. Hon. Lord MacMillan, and Mr. W. E. Price. Other new elections included five Members, thirty Associate Members, and twenty-five Associates.

It was then that Mr. Bennett announced the election of Colonel Carr to the Presidency for the year 1935-36. The new Vice-President for the period 1935-37 is Mr. H. C. Smith, the Auditors for the new session are Messrs. Madden and Morland, and the Hon. Secretary is Mr. W. E. Price.

Messrs. Thomas Carmichael, A. S. Nisbet, F. J. West, and J. W. Whimster were elected Ordinary Members of Council for the period 1935-38.

Colonel Carr and Mr. H. C. Smith expressed their thanks to the meeting for their election, after which the President referred to Mr. Price, who for twenty-one years has been Hon. Secretary of the Institution. He said that the members of the Institution had endeavoured to express their gratitude to him for his past services by electing him an Honorary Member.

The District Members of Council nominated for 1935-36 are Messrs. T. G. Brockway, Cleethorpes (Eastern Counties); J. A. Rooney, Drogheda (Irish); A. L. Jennings, Spenborough (Manchester); Arthur Roberts, Hereford (Midland); James Dickson, Kirkintilloch (North British);

Langfords Four—Leslie, of Hobart, Tasmania; Cecil, of London; Percy, of Coventry; and Leonard, of Tunbridge Wells.

W. M. Galleway, Whitby (North of England); E. L. Nicholas, Guildford (Southern); Octavius Thomas, Cymmer, Porth (Wales and Monmouthshire).

Gas Sales Policy.

Commencement was made with the technical business on Wednesday morning by presentation of the Paper by Mr. S. B. Chandler on the development of gas sales, with particular reference to the methods employed by the Tottenham and District Gas Company. At the outset the author emphasizes the great and growing need for adequately trained personnel on the sales side—a need long since recognized at Tottenham, where ten years ago a simple apprenticeship scheme was inaugurated which has proved highly successful. The scheme is divided into two sections, one for those whose education is likely to fit them to take up positions of responsibility as inspectors, district, industrial, and special representatives, and so on; the other, the Gas Fitters' Scheme, is designed for those whose future activities lie in the ranks of the fittings staff. Mr. Chandler gives full particulars of these two systems of training. The whole scheme has the merit of simplicity of organization, and its application to small undertakings, with perhaps minor modifications, is quite feasible. The author describes it as "a most efficient means of building up a competent staff."

An ample supply of gas is, of course, a *sine quâ non* of

good service, an essential starting point; and the author explains how such a supply is afforded throughout the Tottenham area. He also gives an account of a highly effective emergency service which is available at all hours of the day and night. Under the arrangement a fitter can be in attendance with the necessary equipment at the

Mr. Archibald Kellock, Airdrie (with Mrs and Miss Kellock), Hon. Sec. of the North British Association, was recipient of a Jubilee Medal—and many congratulations.

furthest point from the centre within 35 minutes of the time of call. Mr. Chandler then passes on to give his views on canvassing, gaining consumers' satisfaction, and showrooms. He strongly believes there is need for an intensive canvassing campaign throughout the whole Industry, and that a system of payment based upon an adequate wage *plus* a reasonable commission will produce the most fruitful results—an opinion based on experience at Tottenham. To show that the Company is anxious to ensure customer satisfaction, it is the practice at Tottenham to write to each consumer after the completion of an order; each installation is followed up. As for showrooms, the author thinks it desirable to introduce women sales attendants. "It is a positive advantage," he states, "to utilize the services of at least one female attendant in every showroom."

Industrial development then comes in for consideration. Having pointed to the value of the Industrial Gas Development Centres, Mr. Chandler refers to the Industrial Department of the Tottenham Company. As a complement to the Department's technical staff it has been found necessary to provide a draughtsman and workshop facilities to design and produce isolated pieces of equipment for which duty no standard plant is available—although the practice of actual construction is only resorted to as a last expedient. So far as maintenance and fitting work on the district are concerned, special men are reserved for these duties, for it is considered that, as in the case of the technical staff, specially trained mechanics are necessary if the benefits accruing from carefully planned schemes are to be fully realized.

Mr. Chandler leaves no one in doubt as to his views on the lighting load, both domestic and public. More serious attention, he maintains, should be given by the Industry to gas lighting, and greater efforts should be made to place before the public the claims of gas for this particular purpose. He puts forward the following suggestions to encourage the lighting load:

(*a*) The provision of properly designed fittings, with switch control, for kitchen and bathroom, these being the most used rooms in the average house; the piping and fittings to be installed without cost to owner or builder, on the understanding that the lighting is exclusive.

(*b*) A conference of leading distribution officials specially to consider public, commercial and domestic lighting matters, in order to evolve a policy and a co-operative form of action to be taken by the Industry as a whole.

(*c*) Encouragement of staffs to take an intelligent and practical interest in local civic activities, *i.e.*, chambers of trade and commerce, rotary and other clubs and associations, and, where politic, their representation upon local councils.

In regard to public lighting, Mr. Chandler cites examples of what can be accomplished by a progressive gas undertaking—examples which reflect the greatest credit on the Tottenham Company.

In 1930 a special Building Development Department was formed at Tottenham for the particular purpose of dealing with new estates. Its function is to keep in touch with those concerned in estate development, placing before them the Company's terms and conditions of supply, quoting for piping of premises and the installation of both gas and coke domestic apparatus, arranging for the equipment of show houses, and generally taking steps to present the case for gas in the best possible way. The Tottenham scheme is very carefully organized. Finally, Mr. Chandler rightly stresses the need for looking after the prepayment consumer, for placing before him attractive schemes and terms whereby modern and efficient apparatus may be acquired.

Quality and Price in Salesmanship.

The importance of having the right personnel engaged on the commercial side of our Industry was stressed by Sir Francis Goodenough, who was the first speaker in the discussion. One cannot do a job without the right tools, and on the commercial side these must be of the right quality if the best results are to be obtained. Also it must be borne in mind that the right tools cannot be obtained unless a proper price is paid for them. Again, even if the right price is paid for the tools of the right quality, these tools will not continue to cut unless they are kept sharp, for which reason Sir Francis pointed to the value of the Domestic Gas Salesmanship Course of the B.C.G.A.

The need for looking after the prepayment consumer, to which reference was made by Mr. Chandler in his Paper, found strong support in Mr. C. H. Chester, of Swindon, where out of a total of 18,000 consumers 14,000 are supplied with gas through coin meters. Mr. Chester thinks that in the design of any two-part tariff some amount should be spared with a view to providing the apparatus to burn the gas. The adoption of this idea at Swindon has contributed largely to the rapid increase in output

From overseas—Mr. J. P. Blackmore, of Bombay, with Mr. J. F. Burgoyne, of London.

during the last three years. To-day this is 27% more than it was three years ago, without taking into consideration any additional districts. In Mr. Chester's opinion a large night load is to be picked up at special prices and over special periods, and this applies particularly to the baking industry. By having special rates between 10 p.m. and

10 a.m., Mr. Chester is developing a baking load which is now equivalent to 10% of his total output.

Mr. P. E. Browne, of Brighton, speaking of the importance of personal contact, mentioned that the electricity industry is favoured in this regard in that every electrical contractor is, willy nilly, a canvasser for the electrical undertaking because he has to live by the sale of his wiring and appliances. We should visualize this aspect when we talk of personal representation in our own areas of supply.

This question of personal contact was discussed by Mr. Hems, of Birmingham, in relation to the development of the industrial load. He explained that the Midland Industrial Development Centre is making personal contact with all the gas undertakings it is serving under the scheme and is endeavouring to establish personal contact between the gas undertakings and their larger industrial consumers. There are several instances in which this has led to important relationships and possibilities of increased business. Such satisfactory relationships should be passed on; and in regard to migration of works to the South, the fortunate undertakings in the South have a large responsibility in seeing that they continue any good work which has been done in the North.

On quite another matter, that of prices, Mr. Hems considered the Technical Committee operating for the various industrial centres is doing extremely valuable work in taking a number of standard large heat-treatment applications and advising subscribing gas undertakings the price at which gas should, if possible, be sold to compete with other fuels for these operations. In this regard Colonel Carr said he was more than nervous about the danger of publishing the cost at which gas must be sold, because in

almost every instance the price which can be obtained for gas inevitably varies, and he suggested that the valuable information which has been contributed by the Industrial Centres should be used with discretion and caution. In regard to gas demonstration houses, Colonel Carr said that in Stretford his Undertaking purchases a demonstration house on an estate and utilizes it during the development of the estate, selling it afterwards. "If," he said, "we are to demonstrate to the public as we feel we should do, and if we are to devote all our energies in that demonstration house to selling gas, it is desirable that the house should belong to the gas undertaking." Moreover, this is really quite a cheap means of advertising.

At this point the President read a message which he had received from Councillor Muter, President of the British Commercial Gas Association, expressing his regret at his inability, for business reasons, to attend the Meeting, and sending his best wishes for a successful conference.

The General Meeting was then adjourned for the meeting of the contributors to the Institution Benevolent Fund, a report of which follows our Review.

Carburetted Water Gas.

On the resumption of the Institution Meeting, the President called upon Dr. Glasgow to deliver his Lecture on "The Technical Use of Carburetted Water Gas as a Coal Gas Auxiliary." Dr. Glasgow, who was enthusiastically received, before coming to his Lecture said that, thanks to the gracious action of the Institution in electing him Hon. Member, he stood before them that day not as a diffident stranger. He admitted one qualification for the honour, however—the longevity of his service in the Gas Industry. "As long ago as 1891," he said, "I participated in the inaugural meeting of the Incorporated Institution of Gas Engineers. In other words, I assisted at the birth of a parent of this Institution. The friendships then begun have enriched my whole life, and in some happy instances are descending into the second, the third, and even the promise of a fourth generation. In 1893 I again read a Paper to the Incorporated Institution, and I well remember joining issue with Professor Vivian B. Lewes regarding our respective processes. In 1899 I lectured to the Incorporated Gas Institute—from which, of course, the members of the Institution had seceded in 1890. At the close of that Lecture there was a very dramatic incident. Messrs. Livesey, Bray, and Sellers, amid most thunderous applause, announced to the Meeting the happy composition of all their differences, paving the way for both memberships to merge in 1903 into this present Institution of Gas Engineers, which was formed for that purpose. At the request of the Council, I attended the Inaugural Meeting of this Institution, therefore assisting at another birth—the birth of this present lusty child. I have no further preferments for midwifery. But, although I was helping in those early days to make history for this Institution and its predecessors, I hope now to prove that I am still in the ring."

The Lecture.

The theme of Dr. Glasgow's Lecture is that the auxiliary use of carburetted water gas affords the only means of substituting gaseous for solid fuel in Great Britain. It not only enables the gasification of raw coal to be continued until it becomes more profitable to sell the still remaining coke as coke rather than as gas, but it also provides—on tap so to speak—peak-load gas at three-fifths the cost (including capital charges) of equivalent peak-load coal gas. Basing his arguments on the treatise by Humphreys & Glasgow, which was published in the "JOURNAL" for Aug. 23 and 30, 1933, Dr. Glasgow appraises the financial savings due to 20% of auxiliary carburetted water gas as 12·7d. per 1,000 cu.ft. of carburetted water gas produced, and the "reflex" benefits in the purchase of gas coal and sale of gas residuals as 15d. per 1,000 cu.ft. If, he says, we credit auxiliary carburetted water gas with only one-half of these "reflex" benefits, it brings the total savings to over 20d. per 1,000 cu.ft. of carburetted water gas—slightly more than the total cost of the carburetted water gas, including capital charges. He points out that during the five years 1929-33, less than 1¼% of pure oil gas was in the town gas distributed in Great Britain, but this small admixture, in the form of 14% of auxiliary carburetted water gas enabled 4,000,000 tons of gas coke to be made into town gas and reduced the make of gas coke by 5,370,000 tons. This 1¼% of oil gas, therefore, caused the elimination of 9,370,000 tons of gas coke. "A small admixture of enriching oil gas with otherwise unsaleable coke gas—in the form of auxiliary carburetted water gas scientifically utilized—may well be the narrow keystone in a broad arch on which rests the future of the Gas Industry." We quote from the Lecture.

Finally, Dr. Glasgow discusses the new duty on heavy oil, which is reducing the benefits to be gained by auxiliary carburetted water gas. "In short," he says, "every consideration—whether constructive or competitive—amply justifies the exemption of gas oil, used exclusively in the manufacture of town gas, from this new duty on heavy oil. From all points of view, it seems clear that national interests would be far better served through the Gas Industry by remission of this gas oil duty, than through the Exchequer by its collection."

A vote of thanks to Dr. Glasgow was proposed by Mr. Henry Woodall, seconded by Mr. John Terrace, and supported by Mr. Walter Grogono. A report of their remarks follows publication of the Lecture on later pages.

Waste Heat Recovery.

There were two Papers on Thursday morning, the final session of the meeting, the first being by Major Gregson on "Waste Heat Recovery from Retort Settings." In this contribution the distribution of the total heat input is studied, and the sources of recoverable heat are discussed, together with the fundamental heat distribution differences between vertical and horizontal practice.

A mathematical analysis is made of flue gas conditions under varying combinations of waste gas temperature/excess air content, this analysis showing the limits of pure regeneration on the secondary air with hot producer gas firing, and the potential steam yields by the application of waste heat boilers.

Dry coke quenching is next discussed, followed by a comparison of (*a*) steam yield from the flue gases of non-regenerative vertical retorts, and (*b*) the steam yield from

the flue gases of regenerative horizontals *plus* steam from dry coke quenching. The following figures for steam production per ton throughput are given: Verticals (producer fuel at 15%) 1,780 lb. from and at 212° F.; horizontals (producer fuel at 13%) *plus* dry coke quenching, 1,405 lb. The author points out that it must not be forgotten that in the case of horizontals coupled with dry coke quenching the capital cost of the dual recovery plant must of necessity be in excess of that of a waste heat boiler on straight verticals.

The next section of the Paper deals with methods for improving the effectiveness of waste heat recovery—*i.e.*, reducing losses from "non-recoverable" sources, after which the general question of waste heat boilers is discussed—first, to explain the fundamental differences between the problem of heat transfer from low grade gases compared with normal fuel firing practice, and secondly the various special problems which have to be dealt with in the design of suitable plant for waste heat recovery.

The limitations of natural draught waste heat boilers are discussed, followed by some notes on the induced draught, high velocity "contact-heating-effect" design of heat exchanger which is the basic design of the modern waste heat boiler.

The Paper then deals briefly with the underlying factors affecting the economics of waste heat recovery on retort settings, followed by a series of test figures on a variety of typical gas-works installations of horizontal and vertical retorts and chambers.

On the aspect of economics the author states that the "recovered" steam can best be assessed as its equivalent in fuel should this steam be generated by coke/coke breeze in ordinary fuel fired boilers, together with due allowance for labour and fuel handling services. The value of such boiler fuel varies from works to works, being determined by the equivalent sales value of the released boiler fuel, this being particularly true of the breeze item. In assessing the latter, there are two aspects to be considered:

(*a*) greater use of coke breeze on setting producers, to replace coke of full market value,

(*b*) the outside sale of coke breeze can be greatly enhanced by taking advantage of recent developments for burning this fuel economically in ordinary boilers. It should be remembered that if coke breeze is exploited scientifically—*i.e.*, as a smokeless fuel of calorific value approximately 0·8 that of good boiler slack coal, and capable of operating at as high a boiler efficiency as slack coal, then if the consumer can buy at *less* than 0·8 the price he pays locally per ton for small coal, it is his most economic fuel.

The amount of steam used on the average gas-works per ton of coal carbonized is a varying factor—depending not only on the size of the works and type of auxiliary plant installed, but also on the degree of mechanical handling necessary for various arrangements in the site available, and the amount of ancillary by-product plant in operation in the works. Figures varying from 800 to 2,000 lb. per ton of coal carbonized have been given by various authorities.

Assuming, however, that water gas plants are rendered self-contained by their own waste heat boilers, it is quite normal practice for the waste heat boilers on the retorting plant to deal with the rest of the works' steam and power requirements. In certain cases load fluctuations call for subsidiary steam—either from fuel fired boilers or "make-up" producer gas on the waste heat boiler plant—especially during periods of low carbonizing load, when the works' steam requirements do not fall *pro rata* with the retort house throughput. In certain cases, auxiliary firing can be dispensed with by a steam accumulator system—*i.e.*, to absorb overplus of steam when available at certain times of the day, to meet peak requirements.

Value of Mechanical Draught.

Commenting upon the recovery of sensible heat in the discharged coke by dry quenching plant, Mr. F. M. Birks, who was the first speaker in the discussion, suggested that the Author's treatment of this subject appeared to presuppose that such plants could only be applied to coke ovens or horizontal settings. The system is, however, being applied to intermittent chambers at Southall. The plant, as at matter of fact, is not yet completed, so that working results cannot be given. Major Gregson in his reply admitted that he should have mentioned intermittent vertical chamber ovens in connection with the dry quenching of coke. Another point mentioned by Mr. Birks was a new type of waste heat boiler fitted with sinuously formed tubes. This type of boiler—the "Sinuflo"—was dealt with by Mr. Kirke, who detailed its advantages.

Colonel Carr suggested to the Author that there is an advantage in horizontal working of combined regeneration and waste heat recovery, and he thought that Major Gregson might have stressed in his Paper the enormous advantage of mechanical draught in carbonization. Those with experience of the operation of any type of setting with natural draught, said Colonel Carr, and who have worked similar settings and waste heat boilers, appreciate the difference in control; and while comparisons of actual figures are difficult to obtain to show the advantages in regard to fuel of mechanical draught as against natural draught, he suggested that on an average, taking a period of twelve months, it is somewhere between 7% and 10%, which alone justifies the utilization of waste heat boilers. With absolute confidence and with real economy Colonel Carr has placed waste heat boilers with mechanical draught on small continuous vertical settings of only two retorts.

Mr. D. L. Browne said that at Brighton they were thinking of experimenting with by-passing a portion of the regenerators in their settings with a view to boosting up the temperature of the waste gases and increasing the

steaming of settings. In this regard, Colonel Carr suggested that before cutting out the regenerators at Brighton they should concentrate still further upon the matter of air infiltration, because from his experience of horizontal settings he has found that a leaky sight-hole in a bench comprising 100 retorts will increase the excess air and the waste gases from those retorts by as much as 7% to 10%. He urged the training of the retort house staff to ensure absolute prevention of air infiltration. Mr. Browne, discussing the question of fan drive, said that it had been

found at Brighton that fluctuation on works load causes corresponding fluctuation in the steaming pressure available and has given trouble in the way of fan speed variations, and in their case electric drive is preferable. Moreover, it requires less general care and maintenance. On this question Colonel Carr said that it had paid him to scrap the electrical drive and to install a high-speed steam engine in its place. He gave figures to show the considerable saving resulting from this change-over.

Welcome to Herr Escher.

At the close of the discussion the President rose to welcome Herr Fritz Escher, the Past-President of the In ernational Gas Union and now the Hon. President of that Union. Herr Escher, who was greeted with prolonged applause, said how deeply he felt the hearty welcome which the members had extended to him. His presence at the meeting was to convey the greetings of the Swiss Gas Engineers and to express their thanks for the visit of the British delegation to the International Gas Convention in Zurich in 1934. He added his personal thanks for the opportunity of entering the " the British gas family."

Marketing of Coke.

This brought us to the final Paper of the meeting—" The Preparation, Marketing, and Utilization of Coke," by Mr. Boon, who rightly maintains that the subject deserves the close consideration of every undertaking producing coke for sale, for the receipts from coke and the revenue of the undertaking can be substantially increased by a full appreciation of the problems entailed. In the public mind, he says, coke is not yet sufficiently distinguished by degrees of quality; and care in preparation, grading, and servicing are not appreciated in the measure which they deserve. It will take some time completely to dissipate the prejudice which has been inherited as a legacy from the days when coke was an unsatisfactory product. But that great progress has been made is evidenced by the status which coke has achieved at the present day. In two decades it has advanced to a prominent position in the commodity market, from being in fact almost a waste product, while from the aspect of revenue it is to the Industry second only in importance to gas. Much more remains to be done if full advantage is to be taken of the markets which are available and can be developed, and for which gas coke is logically well suited.

There should be no anomaly in the Gas Industry selling successfully two fuels, gas and coke, regarded in some degree as competitive; a wise policy will develop coke as a complementary and remunerative supplementary fuel to gas. There are those who believe that the Gas Industry cannot continue successfully to sell an inferior and relatively crude solid fuel in this way and who hold the view that money expended on the careful preparation of coke is uneconomic. An impartial and clear view of the future must surely indicate that solid fuel will be used in this country for many decades to come. The convenience factor of gas, whilst recognized, remains costly, and it would be an exaggeration to envisage the possibility of gas becoming, in our day at least, always comparable in cost with coke. What is more probable, is that if the Gas Industry ceased to supply coke, the effect would be to engender competition in the shape of gas made by the producers of smokeless fuels, the demand for which would enormously increase as a direct consequence. The general view points towards a profitable future for smokeless fuels, and the Gas Industry should be stimulated by the growing and strengthened demands to make the best of its opportunities.

The gas undertakings of the country sold 7½ million tons of coke in 1934 without serious sales effort, the Industry concentrating its energy on its sales of gas, coke being relatively and disproportionately neglected.

Expenditure on plant and the efforts of the works staff to produce a higher and better quality product will be gravely discounted if the marketing of the commodity is not equally well studied and developed. The fact that gas coke has sold relatively so well in recent years is of no great credit to the sales effort expended upon it by the Gas Industry as a whole. It is due rather to the inherently beneficial characteristics which coke naturally possesses as a fuel; a circumstance capable of exploitation to greater advantage than has generally been the case.

It is, in fact, essential that the Gas Industry should take full advantage of all and every means to increase its revenue from coke because of the effect that this would have on the price of gas, to which at present coke contributes between 1½d. and 2d. per therm. Unlike gas, no undertaking has any monopoly on the sale of coke in its own area, so that not only has coke to compete with other fuels, but it has to compete with any coke sent into the area by other producers. The necessity for a better and more intelligent sales policy for coke is pressing, and the future can be regarded confidently if action is taken.

Ordinary gas coke, states the author, is not suitable for all open coal fire grates as an all-purpose fuel, and still less so is metallurgical coke. Therefore, if the Industry is fully to utilize the solid fuel which it produces, it must recognize the necessity for and sponsor the adoption and installation of new grates.

A suitable all-purpose coke, he continues, may at some future time be produced by present methods of high temperature carbonization, but the Gas Industry should not wait for this and sacrifice its immediate opportunities. The use of expedients, such as spraying with crude oil emulsions or with solutions of coal dust, in an endeavour to make coke a better all-purpose commodity, should not be necessary, if the product is adequately prepared and properly utilized.

Sales are notably sensitive to quality, and non-uniformity between deliveries probably causes more dissatisfaction to users than any other single fault. National specifications for domestic coke for both open and closed boilers would be of definite advantage.

Considerable controversy has surrounded the question of grade sizes and the possibility of adopting a national nomenclature for coke. It was realized in the early days of the London and Counties Coke Association that standards should be laid down and the Technical Committee of that Association, after very lengthy consideration of the problem, recommended to all its members the adoption of the following names, numbers, and sizes for graded coke:

Name.	Number.	Size.
1	2	3
Large or unbroken coke	1	Over 2 in. (square mesh)
Broken coke	2	Within the limits of 1-in. to 2 in.
Coke boiler nuts	3	,, ,, ,, ½ in. to 1½ in.
Forge beans	4	,, ,, ,, ⅜ in. to ⅝ in.

These grades have been used by the majority of gas companies in London and the home counties area for some three years and have been generally regarded as sufficient and satisfactory.

A questionnaire reviewing this whole matter has this year been circulated to 152 gas undertakings. The answers indicate that the system which the Committee originally suggested has fulfilled their requirements, and it is the general opinion that it is unnecessary to sub-divide further these sizes or to alter the nomenclature.

It would be of great advantage if a more general use could be made of this nomenclature, even supposing that it may have limitations. The trade still suffers from a great variety of names which have grown up in districts by ancient usage, and which are not conducive to good marketing or compatible with the needs of the Industry. The use of such terms as apples, chestnuts, potatoes, &c., are to be deprecated as causing unnecessary confusion.

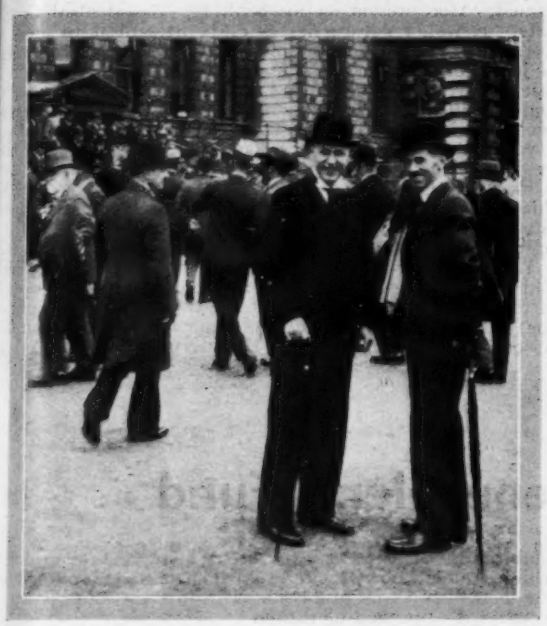
Competitive fuels and the systems of using those fuels are increasing, and an intelligent knowledge of their capabilities is required. More active co-operation between the merchants and producers is recommended in the Paper, particularly from the point of view of understanding and satisfying the requirements and demands of the client with whom closer contact is essential. Sales policy should follow the line that the gas undertakings are out to make one ton of coke do the work previously required by two tons. There would be no fear in such circumstances that the public would continue to look upon coke as a waste product. Coke is not so flexible or as adaptable as coal, and for coke selling an entirely different technique is necessary. The old barter salesman who allows 6d. per cwt. off a consignment to soften complaints, or who promises the next delivery at a cheaper rate, is out of place. A National Coke Organization is necessary, with Regional Associations, through which the Coke Industry can become stabilized and actively represented in all its development.

A closer knowledge of the appliances for the utilization of coke is necessary. That there are great possibilities in the direction of new appliances is evidenced particularly by the gravity feed boiler and the open coke fire, both of which can be exploited much more effectively to the benefit of the Industry.

"Money-Making Suggestions."

" Those who do not agree that the gas-*cum*-coke policy is a wise one may possibly have overlooked the fact that there are yet jobs best done with coke . . . there are those who prefer coke to other forms of heat. Unless we go out for this valuable market by producing a first-rate

fuel and putting that fuel before our customers in an attractive manner, we may find that other smokeless fuel producers are in the position of describing themselves as the premier fuel suppliers in this country." This quotation is from the remarks of Mr. Restall, of Stalybridge, who opened the discussion on Mr. Boon's Paper. He suggested that we are too haphazard regarding our dealings with coke users, who require as careful attention as the



value of the fuel demands; and as the value increases so must the attention. Mr. Restall is of opinion that dry-cooled coke should be placed on the market and also that the coke made should be of a hardness sufficient to withstand rough treatment, so that as much as possible of the smalls and breeze is eliminated before the coke is ready for delivery to the user. He gave figures to show the great advances in the sales of graded coke by his Undertaking during the past three years, and concluded his remarks by describing Mr. Boon's Paper as being "outstanding in money-making suggestions."

The Meeting was very glad to have the views of Mr. F. W. J. Belton, of Christchurch, New Zealand. First of all he questioned whether new grates are essential if gas coke is to be used. He is marketing a coke containing 3½% of volatile matter and about 9% of ash. It is sized correctly, and he finds no difficulty in burning it in the majority of open firegrates. He believes that ordinary coke advertising is wilfully inadequate and futile. His idea of promoting coke sales, and the results of this idea speak for themselves, is to distribute sample bags of coke free to consumers. Being worried about the coke sales in the winter of 1931, he sent on to the district 17,500 coke samples. In that year he sold 5,850 tons of coke. In 1932 the sales jumped to 7,000, the 1933 figure was 10,300, and in 1934 he sold 12,400 tons. We shall be interested in the 1935 figures. All this increase, of which 85% was in respect of coke used in the domestic grate, involved the sale of only 50 special coke fires.

Mr. Townsend, of Colchester, advocated the storage of coke only in the graded form. His primary purpose of joining in the discussion, however, was to tell the members something of the activities of the London and Counties Coke Association. The work done by that body, he said, is unique, but it has not been recognized sufficiently. In a period of only three or four years practically the whole of the coke produced in fourteen counties—and this represents 43% of the total gas coke produced in the country—has been sold by the Association. This is the result of co-operation, in the fostering of which Mr. Foot, of the Gas Light and Coke Company, has played a leading part. On behalf of the Executive Committee of the Association, Mr. Townsend told the members of the Institution that the Association was only too ready to place at the disposal of the Industry any information available. The work had so far progressed, he explained, that they could now offer an all-in charge for the heating of buildings over a definite period. This charge includes all labour and attention, which system, in effect, means that coke is on an equal footing with oil or any other fuel.

Wet or Dry Quenching?

The question of coke quenching was discussed by Mr. R. N. Webb, of Leeds, who, as a result of his experience at the New Wortley Works, has come to the firm conclusion that water quenching can be so carried out that the difference between this system and dry coke cooling can be very little indeed. In regard to the production of breeze, he also expressed the opinion that the figure for the amount of water used for coke quenching is unnecessarily high at 1½ tons per ton of coke. He anticipates that in the near future he will not be using more than 50 gallons of water per ton of coke made and that the moisture content of the quenched coke will not exceed more than 3% or 4%—which brought him to the point that it is possible to pay too high a price for the recovery of the sensible heat in the coke. Moreover, he thinks that a perfectly dry coke is neither advantageous nor necessary. We were interested, but not surprised, to learn from Mr. Webb that as the result of the installation of grading plant the Leeds Gas Department during the past twelve months has sold from the New Wortley Works alone over 5,000 tons more coke than in the preceding three years.

The last speaker in the discussion was Dr. F. M. H. Taylor, of the Gas Light and Coke Company. He mentioned that during a period of just over two years his Company has modernized over 200 installations of coke plant and conversions from the burning of other fuels. The actual conversion of existing plant numbers over 100, of which nearly 100 have been large steam-raising plant, such as are used in laundries, factories, and public baths. The total advance due to conversion alone, involving absolutely new sales of coke is 65,000 tons per annum. Dr. Taylor stressed the need for adopting a policy of co-operation with heating engineers and contractors.

Concluding Proceedings.

The President reported that the 1st Annual General Meeting and 2nd Annual Dinner of the British Gas Federation will be held at Grosvenor House, Park Lane, London, on Nov. 4 next. That the Research and Education Reports of the Institution for 1934-35 will be presented at the 7th Autumn Research Meeting in London on Nov. 5 and 6, and that the 73rd Annual General Meeting of the Institution will be held on May 26-29, 1936.

Mr. C. S. Shapley, of Leeds, proposed an omnibus vote of thanks to all who had contributed to the success of the meeting. He said how much everyone appreciated the work of the Secretary and his staff, who had carried out

all arrangements excellently. The vote was seconded by Mr. W. M. Galleway, of Whitby, and was carried with enthusiasm.

The President, who accepted the expression of goodwill, called upon Mr. Alexander to speak. "He is," said Mr. Bennett, "a man for whom I have the greatest respect, he is the best organizer I have ever met, he has a store of energy which it seems impossible to exhaust, and his de-

sire to see this Institution progress is such that he has imbued the whole of his staff with it."

Mr. J. R. W. Alexander, who was received with applause, said that since most of the members of the Institution were officials, they would readily appreciate that the greatest reward one could have for one's work was the knowledge that it was regarded as successful by those for whom it was carried out. During the war the expression "tails up" meant a great deal in the Royal Air Force, and he suggested that it indicated precisely the position of the Institution to-day. "My staff and I," remarked Mr. Alexander, "will do all we can, by playing our part as enthusiastically and loyally as we have done in the past, to keep the Institution's tail up. There never was a time when it was more important than it is now to ensure that the Institution's position should be a strong one, whether one regards it from the point of view of the individual member or of the Gas Industry as a whole."

Presentation of Presidential Certificate.

Colonel Carr then proposed a hearty and sincere vote of thanks to Mr. Bennett. "Mr. President," he said, "you have done a wonderful year's work. You have enhanced the reputation of this Institution; you have set an example in the conduct of our business, both at the Autumn Research Meeting and at this Meeting, which I suggest is not only business-like but statesmanlike."

In presenting to Mr. Valon Bennett the Presidential Certificate, Colonel Carr shook him by the hand and said: "We thank you for your wonderful work; we know that we can call upon you in the future and that you will work as willingly for us as you have worked on our behalf in the past year. On behalf of the Institution, I thank you most sincerely."

The President, who was greeted with prolonged applause, said that his year of office had been an onerous one but extremely pleasurable. "I thank you very much," he continued, "for presenting me with the Presidential Certificate. It would not be necessary to present it to me if it were meant only to enable me to remember the year which is just closing, for I shall never forget it. But it is a tangible recognition of that twelve months' experience, and I shall prize it for the rest of my life. I ask all connected with this Institution that they shall ensure as happy a year to my successor as I have had, by supporting him as loyally as they have supported me during the last twelve months. I have already told Colonel Carr that by this time next year he will have done 'twelve months' hard labour.' But his duties will have been eased by all the friends who surround him."

The Secretary read further messages of greeting which had been received during the meeting from the President of the Polish Gas Association, from the General Manager of the Dutch Gas Association, and from the Yugoslavian Gas Association, and the meeting then terminated.

The Institution Benevolent Fund

The General Meeting of the contributors to the Benevolent Fund of The Institution of Gas Engineers was held in the Great Hall of the Institution of Civil Engineers, Great George Street, Westminster, on Wednesday, June 5, 1935—Mr. C. VALON BENNETT (the President of the Institution) presiding.

The PRESIDENT: It is my privilege to move: "That the Report of the Committee of Management of the Benevolent Fund of The Institution of Gas Engineers for the year 1934-35, and Accounts for the year 1934, which have been printed and circulated to contributors, be taken as read and adopted."

The resolution was carried.

The PRESIDENT: I am afraid that, as always happens at these meetings, the Chairman is preaching to the converted. I endeavoured in my Address yesterday, when we had a very large audience, to say something which might increase the number of contributors to the Fund, and I can only hope that my words did not fall upon stony ground. To all you gentlemen here I would appeal that you should do what you can among your colleagues who do not subscribe to this Fund to persuade them to become subscribers. I can assure you that the letters we receive, asking for help, are truly heart-breaking. It is impossible, of course, for us to disclose who are the writers of those letters, or what the letters contain, but you can take it from me, as one who has been interested in the Fund for many years, and who has endeavoured to increase not only the number of subscribers but, what is more important, the amount of subscriptions, that the cases of hardship are really terrible. If you talk this matter over when meeting in your district associations and can think of any schemes by which we can achieve the result we all desire, I trust you will make it your duty to see that the Secretaries of your district associations convey in writing to our very faithful Hon. Secretary, Mr. Alexander, the views expressed at the meetings, so that the Committee of Management may have plenty of time to consider the suggestions and, if thought fit, to put them into action.

The number of contributors to the Fund in 1934 was 922 and the membership of the Institution was 1,525. We have a long way to go, gentlemen. I want you, if you will, to be ambassadors in the name of this Fund, and if possible to see that we are 100% contributors to it. I feel very strongly on the subject.

Mr. WALTER T. DUNN: The Members of Council have noticed that the Birmingham Fund is accumulating. I remember an occasion on which a grant was made by the Council from the Birmingham surplus to another object. Supposing our Benevolent Fund is in very great need of further money for some special case. We have a balance of only £62 on the year's work, and we have no reserve, and it behoves us to do all we can to increase the subscriptions. I suggest that the Committee of Management, in conjunction with our Council, might consider, if at any time the necessity arises, the use of some of the surplus to which I have referred. As we are spending the money for the benefit of the profession I think the suggestion is worthy of some consideration.

Mr. W. CLARK JACKSON: I do think that the very sympathetic and cautious letters which are sent out do not get down to the pockets of the members who are not at present subscribers, and I think the Committee will have to consider doing something just a little more drastic. I feel that if a rather more brutal type of letter were put together, and a registered envelope were sent with it, accompanied by a slogan such as "Do it now" or "Put in your money and re-post," it might have some little effect.

Mr. C. F. BOTLEY: I sometimes think we are a little inconsistent. I would remind you that most hospitals deliberately run themselves into debt. Do you not think that if, instead of showing a surplus, we showed a deficit, and said that we must have money to get us out of debt, we should get more response from those who do not at the moment think about this matter seriously?

The PRESIDENT: The scrutineers of the ballot for elections to the Committee of Management for the period 1935-38 report that Mr. D. C. CROSS (Lea Bridge) and Mr. A. L. HOLTON (Manchester) have been elected.

Mr. R. H. RUTHVEN (Ramsgate): It is my privilege to propose a vote of thanks to the Management Committee and the Hon. Secretary for their control and management of the Fund during the past year. In connection with our President's remarks, we might impress upon those who are privileged to be members of our Institution that that privilege carries obligations, and that it should be an obligation upon them to contribute some small mite towards this Fund. I might point out that if a member subscribes 5s. only per annum, it is equivalent to two cigarettes per week throughout the year; that is all they would be called upon to sacrifice, but such annual subscriptions from every member who does not now contribute would place our Fund in a very different position from that which it now occupies. It would help us to do a great deal more than we have been able to do so far.

Mr. G. LE B. DIAMOND (Folkestone): It is with very great pleasure that I rise to second the vote of thanks to the Chairman, the Committee of Management, and the Hon. Secretary. In particular I wish to endorse most heartily Mr. Ruthven's references to our President, who, as Chairman of the Fund, has done so very much to further this good work.

The PRESIDENT: On behalf of myself and the Committee of Management and the Hon. Secretary, I thank you very much indeed for this expression of thanks. It is not really necessary, because our work is a labour of love, though I can assure you that it occupies a good many hours of our time, and it is nice to know that our services have been appreciated.

Presidential Address

of

CHARLES VALON BENNETT, M.I.Mech.E.

(Engineer, Manager, and Secretary of the Rochester, Chatham, and Gillingham Gas Company).

Delivered on the opening day of the 72nd Annual Meeting of the Institution of Gas Engineers, in London, Tuesday, June 4, 1935.

The highest position to which a Gas Engineer can attain in his profession is to become President of The Institution of Gas Engineers. In June, 1934, you elected me to that office. It is difficult to find words which would adequately express my deep appreciation and I ask you, therefore, to accept my assurance that I sincerely thank you all.

I have endeavoured to carry out my duties as my predecessors have done, by upholding the dignity of the Institution and by promoting its prestige and usefulness. Any failure in achieving this is due entirely to me and any success must be attributed to the Council, Members, Secretary, and Staff.

I remember hearing a celebrated soldier declare that, when he attained the highest possible position in *his* profession, he found it to be the coldest and most cheerless spot in the world, for it was not for him to consort with others, but merely to issue commands, none of which could be questioned by anyone. Whilst the positions are fortunately not quite analogous, *I* have found exactly the reverse. All past occupants of this Chair will agree when I say that the President of this Institution finds himself surrounded by friends ever anxious cheerfully to assist, no matter whenever or wherever called upon. It is this splendid spirit which makes one very busy year of life so pleasant.

I would pay tribute to my Directors for the assistance and encouragement they have given me. I am now serving a Board quite different, as far as personnel is concerned, to those gentlemen who were in office when I was first elected a Vice-President of the Institution, but their support has continued unchanged. I also desire to express my sincere appreciation to all the members of my Staff who have been loyal to a degree and have ever shown their anxiety to assist.

Research.

With the presentation at the 6th Autumn Research Meeting of its Fifth Report, the General Research Committee came to an end by virtue of a Scheme of Research and Technical Re-organization adopted by the Council of the Institution. Under the new regime an Advisory Committee on Research, a Research Executive Committee, and a Technical Assistant Secretary were appointed and are actively functioning. I will not now make further reference to the subject, since the Institution's research work is dealt with at the Autumn Research Meetings.

The constantly expanding sphere of gas utilization in industry and the home is bringing into prominence certain aspects of gas purification which have hitherto been less urgent. For example, whilst the deposition of gums from gas is objectionable at the Works, it is a far more serious matter on the District where there is a variety of appliances with precision regulation. Research, both in this country and abroad, is being directed towards a closer understanding of the mechanism of gum formation in gas and to devising suitable methods of preventing it, or at least of ensuring that its occurrence is confined to parts of the Works where it will cause a minimum of interference.

Again, research into corrosion due to the combustion products of gas and the growing interest in flueless appliances are causing increased attention to be directed towards reducing to negligible proportions the sulphur content of gas. Very low sulphur contents have been attained in regular working by certain Undertakings by methods of catalytic purification or by means of active carbon, but still more complete removal is now suggested.

In connection with the experimental plants which have recently been erected in Germany for rendering gas "non-poisonous," by converting the carbon monoxide present into carbon dioxide, it is worth noting that the catalytic process used is claimed at the same time to produce a purer gas from the point of view of hydrocyanic acid, naphthalene, and particularly sulphur. The technical and economic aspects of these experiments are being closely watched by the Institution.

The use of creosote as fuel in mobile spark ignition engines has not achieved the success that was at one time hoped for it, partly on account of unsatisfactory results recorded by various users (which, however, could probably be improved by further experimentation) and largely owing to the difficulty of obtaining throughout the country adequate supplies of a standard grade of creosote suitable for the purpose.

Highly satisfactory results are reported, however, for creosote in stationary spark ignition engines. In compression ignition engines Tar Oils have not so far been found suitable by themselves, but have given satisfactory results when their spontaneous ignition temperature was lowered by the addition of certain chemicals or of Diesel oil. Creosote can, on the other hand, be readily converted into lower-boiling motor fuels by hydrogenation. Its market value has increased considerably in recent months.

The recovery and refining of Benzole continue to be practised by a number of Gas Undertakings and constitute a valuable national asset. The inhibitor process of refining, which has enabled refining losses to be markedly reduced, has introduced new problems, notably the removal of sulphur from Benzole down to the limit allowed by the specified standard. These difficulties are, however, being satisfactorily overcome—as, for example, by the methanol soda process for the removal of carbon disulphide.

The profitable utilization of Ammonia is a problem which continues to exercise our technical staffs. Although the market value of Sulphate of Ammonia is not so low to-day as it was, there are many Undertakings who find that its manufacture still brings no financial gain. The research staff of the Institution have, accordingly, had under review for some time alternative outlets for Ammonia, either in the form of compounds other than Sulphate, or as concentrated liquor, or, as a last resort, the least objectionable methods available of running it to waste.

The policy of devoting increased attention to the preparation of Coke for the market and, in particular, the separation of Coke into uniformly graded sizes to suit the requirements of the various domestic and industrial heating appliances, represents progress in the direction of greater satisfaction to the consumer and hence increased consumption. Size grading is not, however, the only direction in which greater uniformity is desirable. Ease of ignition and flexibility of combustion will depend on a variety of factors, such as the method of carbonization and the nature of the coals used. The consumer expects uniformity not only in size, but in the combustible properties of coke required for a particular purpose. Research which is being carried out with a view to correlating practical performances with a simple laboratory test, is placing in the hands of the producer a means of controlling the uniformity of his coke in regard to combustible properties and may afford a simple and rapid means of determining the conditions under which any given make of coke should be burnt to ensure maximum satisfaction.

Solid smokeless fuel for the open grate deserves more attention than it is commonly given by our Industry. Much is admittedly being done by the installation of types of grate specially designed to burn the more combustible grades of coke, but there remains a wide public ready to welcome, at a reasonable price, a solid smokeless fuel which will burn without special attention in existing types of open grate. Low-temperature coke is being produced in increasing quantities, and it must not be overlooked that increasing attention is being given to the domestic market by coke-oven technicians who, during the recent years of diminished demand for metallurgical coke, have gained much practical experience regarding the possible production of free-burning open grate fuel in a coke-oven plant. Our Industry should take note of the growing competition in this field, and should give more attention to the various possible methods of satisfying this waiting market.

The London and Counties Coke Association has met with great success and—although I appreciate proposals have been made and examined for the formation of similar organizations elsewhere and that they have not yet, owing to practical difficulties, been brought into being—I suggest further efforts should be made to see if other Associations,

with benefits similar to those attaching to the one I have referred to, cannot be constituted.

The Gas Industry is from time to time reminded that it is not concerned solely with the production and supply of gas, but that it embraces the manufacture of a variety of chemical products of definite value both to the public and itself. We should be lacking in vision, therefore, if we ignored the possible future uses for the Industry's gaseous products for purposes other than heating and lighting. The synthetic production of Ammonia from coal-gas is, of course, well known. A more recent synthetic process is the production of a motor spirit from water-gas, which is now being tried out on a commercial scale in Germany. The individual constituents of coal-gas and water-gas may be regarded as the raw materials for the building up of a very wide variety of chemical products, and may in the future form the basis of an important new branch of chemical industry.

Holding Companies.

Holding Companies appear, for better or worse, to be steadily acquiring a broadening grip on the Gas Industry. Whilst it is unlikely that the opinions we have formed are identical, we must recognize that the Holding Company movement is not confined to our Industry nor to our Country, but is essentially a symptom of all contemporary economic evolution and the " Spirit of the Age."

In certain parts of Europe the absence of tradition has enabled the tendency to evolve more rapidly. In Italy the control of industry is claimed to be in the hands of a Corporative State; in Russia a still more Corporative but Socialist State has been evolved; while Germany appears to be developing largely upon the lines of Italy. In America, President Roosevelt's " New Deal " has, by its system of Codes, made each industry more bound together than ever before in the history of that highly invidualist Nation.

In this Country the small-scale *control* of industry—which must not be confused with the small-scale production of the last century—is being replaced, at an increasingly rapid rate, by a control which, frequently with the assistance of the Government, has brought many sources of production within one uniform system. The Coal Industry has been forcibly rationalized, the structure of the Electrical Industry was thrust upon the Country by governmental dominance, while the multitudes of Boards for anything from Pigs to London Transport testify to the assistance given to this movement by the Government.

So far, the Gas Industry has largely escaped recent governmental interference, but it cannot escape the necessity of increasing its competitive powers by co-ordinated efforts. Rightly or wrongly, it is the opinion of certain persons and groups that Gas Undertakings, when joined in some form or another under a unified control, which may be only financial, are more efficient than when operated as entirely separate Concerns. Accordingly, Holding Companies have appeared. It cannot yet be determined if all the expectations of those connected with this development in the Gas Industry will be fulfilled, nor if the fears will be realized of those who believe that the movement is not a wise and healthy one. It can, however, be said with certainty that, unless these Holding Companies are operated in conformity with the experience and tradition of the Industry and its obligations as a Public Utility, they cannot attract a full measure of support. Some Gas Undertakings would benefit by being allied to larger Concerns, but the view is held by the vast majority that any control must be of the " finger-tip " type. For instance, the benefits of the " big brother " can and will be entirely nullified if local conditions are ignored and if the real pride which provincial towns have in the local Gas Company is destroyed by the Undertaking losing its local identity. Public Utility Undertakings must avoid the ever-present danger of becoming bureaucratic, for their success or failure depends almost entirely upon the goodwill of a localized body of consumers, the apparent beneficiaries of extreme competition.

The recent development of the Holding Company principle in the Gas Industry has caused much uneasiness in the minds of many Engineers and Managers because they, knowing that high prices have been bid for Stock in other Gas Undertakings, wonder when such offers are to be made for the Undertakings they serve and, if they are accepted, what the position of their Company and themselves will eventually be. I know this fear is *real* because many Engineers and Managers have been good enough to confide in me. Every Engineer and Manager has the interest of his Undertaking at heart and it is natural for him to be concerned as to his future in the event of his Company passing into other hands, mainly by reason of, as it appears to him, the abundance of cheap money having caused envious eyes to look round and see where profit could be made. As at present generally administered, the Gas Industry is one, and many Officials feel that neither the Industry in general, the Company they serve, nor themselves should suffer merely by reason of financial opportunism.

Legislation.

The Gas Undertakings Act, 1934, has given to Gas Undertakings relief from a number of restrictions which the Industry, in its desire better to serve the community, found so irksome and restrictive; but the Industry is *still* labouring under conditions which do not give it the same freedom as is accorded to other Public Utility Services.

Nevertheless, in the matter of Gas Charges, for example, we must see that such freedom as has been obtained under the Act is taken advantage of. There *are* ways and means of charging for gas other than those which have obtained for so long, and it is the duty of each Undertaking to see that a system of charges is adopted to suit the particular conditions applicable in its locality.

International Gas Union.

It has been my pleasant duty to visit many places during the last twelve months, and I recall with particular pleasure the one which I made, in company with a number of others, to Zurich in September, 1934, for the Second International Gas Conference of the International Gas Union. The Conference was presided over by Herr Fritz Escher, of Switzerland, who has been succeeded as President of the Union by Mr. A. Baril, of Paris.

The Report on " Methods for the Development of the Use of Gas for Domestic Purposes," which I had the honour to present, was well received and discussed. Our Colleagues abroad realize the standard we in this Country have set out to achieve in regard to the subject matter of the Report. Our contribution to the proceedings convinced the Delegates from other Countries that co-operative advertising, such as is carried out in this Country under the auspices of The British Commercial Gas Association, is of the highest importance. A suggestion in the Report that the member Gas Associations of the Union should exchange advertising matter has been given effect to.

The Conference was a great success and the value of the Meetings of the International Gas Union cannot, in my opinion, be over-estimated for—although the language difficulty is a real one—we are brought into contact with gas men of all nationalities and learn of their successes and failures. They, too, know of ours, and thus there is created a sympathetic understanding which must benefit all who are privileged to serve the Gas Industry. Further, this exchange of ideas aids in welding together all men and nations of goodwill, thus promoting the interests of World Peace.

The British Gas Federation.

The British Gas Federation held its Inaugural Dinner in November last, and the fact that Lord Macmillan consented to become its first President is evidence—if such is necessary—that the Gas Industry is one of vital importance.

This new Organization embracing, yet in no way interfering with, the constitution of The Institution of Gas Engineers, The National Gas Council, The British Commercial Gas Association, The Society of British Gas Industries and The Gas Companies' Protection Association, is the only one which can, if necessary, speak with one voice on behalf of the Gas Industry as a whole and it will, I am sure, consolidate the position and increase the prestige of the Industry. Many feel a little restive and critical because the Federation does not appear to have been very active. Let me assure them that it is at work. I say this because I am anxious the idea should not get abroad that it is doing nothing. It was a great step forward to enable the five National Bodies to agree to and become Members of one organization and, that being so, it is essential no false move be made which might result in irreparable damage being done. I have no fear as to the ultimate success and power of The British Gas Federation.

Joint Co-ordinating Committee.

In his Presidential Address last June, Mr. Frank P. Tarratt expressed the hope that the Joint Co-ordinating Committee would " provide a lead on many important problems, by communicating its views to those responsible for the conduct of Gas Undertakings." The Committee—which consists of really active and representative persons—meets regularly and gives consideration to many important matters which can only be dealt with by such an organization. The result of its labours cannot always be made apparent as such, but I feel certain that its work, which is

continuing, has resulted in my predecessor's wish being fulfilled.

National Organizations.

The recent raising of the joint subscription to the three National Bodies to ten shillings per million cubic feet of gas made was a step long overdue. If there are present any representatives of Gas Undertakings which have not yet decided to contribute upon the new basis, I sincerely trust they will make yet further efforts to convert the members of their Boards or Committees. Every Gas Undertaking and every manufacturer of gas-producing and consuming appliances must benefit by the work of The British Commercial Gas Association, The National Gas Council and The Institution of Gas Engineers, and it is, to say the least of it, extremely mean to reap a harvest from seed sown by others. It is not necessary for me to explain how vital National Advertising, Parliamentary and Legal watchfulness and Research and Education are, although in some cases it is essential that Engineers and Managers should repeatedly point out to those they serve that they are not partners in this system of co-operation. There never was a time greater than now in the history of the Gas Industry when everyone connected with it should stand four square. Our competitors know this and plan accordingly. The race goes to the strong, and if we are beaten there will be nobody to blame save ourselves.

Benevolent Fund.

The Benevolent Fund is one in which I have taken a great deal of interest, and I recall with gratitude the response to my appeal of a few years ago. I make no apology for taking the present opportunity of again asking for your practical help, since if I make an appeal at a meeting of Subscribers I shall be "preaching to the converted." With this large audience I hope to touch the hearts and pockets of many. If Members had personal knowledge of the hardships which the dependants of many Engineers who have joined the Great Majority are experiencing, I am certain that the number of contributors would be far greater. Some of the cases are heartbreaking, but the Committee, although able to relieve distress to a slight extent, is never, because of lack of funds, in a position to provide that amount of assistance which would properly meet the circumstances. Beyond the small cost of postage and printing, the Fund is run and serviced without charge. There are no heavy overhead expenses, and practically every penny subscribed is available for the purpose of relieving distress I appreciate that in these days there is often very little money to spare and, that being so, it should hardly be necessary for me to point out the hardships being experienced by those dependants of our former colleagues who have difficulty in securing the bare necessities of life. Please do not misunderstand me. I do not ask for a host of large subscriptions (although, of course, they would be welcomed), but I do earnestly plead with each of you to send an annual subscription, even if it is only five or ten shillings, and to let the Honorary Secretary of the Fund have the first of such annual contributions now.

Retrospect and Prospect.

The story with regard to the Sales of Gas during 1934 would have been a very different one had the twelfth month not been the warmest December on record. Climatic conditions then were such that gas fires were hardly necessary and gas cooking stoves, which at that time of year are normally hard at work providing hot meals and drinks, were not called upon to perform their ordinary duties to the usual extent. It was a disappointing climax to what would have proved a good year and it caused a temporary wave of depression throughout the Industry

It will generally be agreed that never before was there such a busy time in the Sales and Distribution Departments as last year. Statistics are not available as to the numbers of cooking stoves, gas fires, water-heaters, wash coppers and other gas-consuming appliances installed during the period, but one Company alone fixed 280,000 cooking stoves, which is equal to one for every two minutes of the day and night throughout the whole year! Let us consider how activity in the matter of installing additional appliances must affect the future. It means, in many instances, that, when we have a return to greater prosperity and normal seasons, numbers of Undertakings may find themselves in the unenviable position of not having sufficient manufacturing and storage plant. With consumption for 1934 not in excess of that for 1933, it is difficult to expect Boards or Committees to incur large expenditure to cover future requirements. That appears to me to be a very short-sighted policy, and those of us who advise the Administrators of Undertakings should emphasize that the cost of plant can hardly be lower than it is at present, that money is cheap and that now is the time to put work in hand and thus safeguard the future. With the return to national prosperity, money must become dearer and, if our extensions are to be put off until then, a higher price must be paid, with the result that, however much we may desire to sell gas at a low price, we shall not be able to do so as easily as will be the case if we embark upon Capital expenditure now.

The installation of millions of gas cookers and gas fires, the adoption of Coke for use in open grates and boilers, has done much to relieve our people and buildings from the ravages of fog of the type known as the "London particular." We cannot entirely prevent fog, but we can do and have done more than any other industry to reduce the filth it contains.

Many people, because they consider it fashionable, have left their faithful servant for lighting—gas—and adopted another form. Many, however, hanker to return and will do so if they are plunged into darkness many more times or if the price of the energy they consume is increased, which is quite a possibility under circumstances which may arise in the near future. Millions of houses are lighted by gas and always will be where reliability and economy are desired. If Gas Undertakings were prepared to make a real effort to retain the lighting load, they would have greater success than they anticipate.

The conditions of December last again demonstrated that the Gas Industry is essentially a Fuel Industry, and that the product of our chief competitor is not and can never be fundamentally a source of heat. Gas, because of its ease of control, its constant quality and its reliability, is supreme wherever and whenever heat treatment is being considered. What then is preventing its even greater use? Is it price, have we not progressed in design and application of industrial appliances, or is it because, having a large domestic load, we have not worried much about the industrial uses? I am afraid it is largely because we have not set out to secure the large, though possibly not (as far as price per therm is concerned) so highly remunerative, consumers. Those Gas Undertakings who, appreciating the value of the industrial load, have already set their house in order are reaping a satisfactory harvest.

The Manufacturer must study very carefully all costs of production and, although the cost of gas may appear, in some cases, a little higher than some other fuels, it is adopted because, *inter alia*, it is not necessary to provide storage, nor is it necessary to employ stokers or highly skilled mechanics to ensure efficient use and guard against and rectify breakdowns. There are many more advantages, as to which, for some reason or another, we have largely failed to convince potential consumers. Conditions in no two towns are alike and it is impossible to lay down any hard and fast rule as how best to secure the industrial load, but with real endeavour and by employing thoroughly efficient men to seek it, the business can be obtained.

The design and application of industrial appliances is receiving proper attention; and the formation of the Industrial Gas Development Centres, although not long established, have proved advantageous. At those Centres are available the pooled experience and brains of many. If any Gas Engineer needs advice upon any unusual problem in connection with the use of gas for industrial purposes, he has only (if his Undertaking is a subscribing Member) to apply for the assistance of the Centre and, if the information is not available immediately because the particular problem has not had to be tackled before, it will very quickly be obtained and the advice of the Centre provided. The Centres can, however, be of little value if the Undertaking, on receiving advice and information, is unable to take advantage of it because of the lack of efficient personnel. Industrial Gas Technicians are not to be found like apples growing on a tree. They must be trained for the work, for which there are openings for young men of education, energy, and vision.

I am sure you will understand me if I make reference to one of my forbears, Mr. W. H. Bennett, who was Honorary Secretary to the Institution for many years. I do so because I want to illustrate how true it is that there is practically nothing new under the sun to which the President of the Institution can allude unless some striking invention or new process has been evolved.

When my grandfather read a Paper before the Institution (then known as The British Association of Gas Managers) in 1877, he was in a critical mood and thought it well to speak plainly to those engaged in managing Gas Undertakings.

The following somewhat lengthy excerpt from the Paper shows that 58 years ago was seen the necessity of providing "service" to consumers, of promoting sales by exhibitions, of keeping the consumer informed as to the possibilities of gas by demonstrations, and of screening and grading coke into sizes. I have not included what he actually said as to

methods of selling Coke, his emphasis being upon the necessity of having numbers of depôts in the towns, and one of his suggestions was that suitable coke-consuming grates should be supplied and fixed in customers' houses at cost price.

"Why is it that gas is not more generally adopted for both lighting and heating in private houses? I shall reply broadly to this by saying that gas companies, as a body, have never sought to make themselves popular.

"I never can divest myself of the notion that gas companies are nothing more than very large shopkeepers, save that they either by force of circumstances or by parliamentary enactment, have a monopoly of the article in which they trade in their particular districts. Does it not, therefore, become the more incumbent on the monopolists, by their liberal treatment—ay, and even by their forbearance—to show that, while their own interests are studied, those of their consumers are kept steadily in view, it being evident that if the public are well and cheaply served, the greater will be the consumption of gas.

"Whether you agree with me in the foregoing remarks or not, I feel sure you will concur with me when I say that, when gas is supplied by companies they should be animated by a desire to increase the use of the commodity they supply and, whether supplied by companies or corporations, it becomes the duty of the supplier to teach the public how best to use this commodity. In the case of corporations, it is their duty, because they allege always as a reason for becoming suppliers, that they seek to do so for the public weal; and on the part of companies it is a duty to their shareholders, because the education of the public in this respect will inspire confidence and of a certainty lead to a true economy, and before long will, with as great a certainty, lead to an increased consumption, and if not an increased dividend, at least to the maintenance of a full one.

"And here I may say I think suppliers of gas have, as a rule, signally failed to do what I think is a duty. It may be said, where are the managers, and how is it they do not take upon themselves this duty? My reply is—and I do not say it simply to please you—they have enough to do under the present system, in the majority of cases, in preparing, planning, constructing, repairing and keeping in going order a large plant often extending over many square miles; in manufacturing, purifying and storing, under circumstances of frequent difficulty, besides the systematizing and supervision of labour that often present still greater difficulties.

"I think, however, that, wherever circumstances have permitted and a manager has gone beyond what are considered as his normal duties, and occasionally taken upon himself to lecture or otherwise instruct the public in the use of gas, great advantage has been the result, not only in satisfying the public that their interests are not neglected and so allaying a spirit of discontent or nipping in the bud an incipient opposition, but in leading to an extended use or an increased consumption.

"Now, in my opinion, companies ought to encourage the managers in this respect, or avail themselves of other means of teaching the true economy of gas lighting and heating. In almost all towns of any magnitude there are mechanics or scientific institutions where an occasional lecture, accompanied by practical illustrations from the manager as to the facility, utility and economy of lighting and heating by gas could be demonstrated with great benefit to both consumer and gas company. For the purpose of illustration, manufacturers would be only too glad to lend such apparatus as may not be kept at a Gas Works, for they lose no opportunity of advertising their wares or exhibiting a spirit of commercial enterprise. People are more impressed with a good lecture, accompanied with illustrations and explanations as to why one system or one apparatus or one mode of lighting is superior to another for particular purposes, than they would be by giving them a score of pamphlets, which are too frequently cast aside unread.

"It has been reserved to the South Shields Gas Company to take a step with regard to the cultivation of the public taste for gas cooking and heating, that redounds greatly to their credit and leaves them a worthy example to be followed. You are, no doubt, well aware that I allude to the exhibition of gas cooking and heating apparatus at South Shields, held in April last, where hundreds of articles, all varying in size, shape and degrees of portability or adaptability to the uses for which they were designed, were to be seen. It is stated that, in the five days that the exhibition was open, not less than 30,000 people were attracted; very many of whom expressed themselves highly pleased with what they saw and complimented the company upon the course they had taken—namely, that of instructing the public in the advantages derivable from the use of gas.

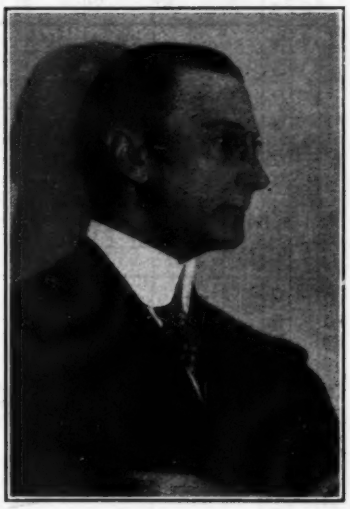
"And now with regard to Coke. What is the reason that Coke is not used more than it is in private houses? I am convinced that the chief reason is because the form in which it is supplied from Gas Works is too large for convenience, and requires to be broken before it is fit for use. It is a common complaint that servants will not use it if they can possibly avoid doing so, and I believe the cause is the labour and trouble the breaking of it entails. But why do not the companies break the coke and supply it in a more convenient form? It is said, because the breaking involves expense and produces much breeze which, in many places, is unsaleable. The Coke, when broken, may be riddled through an apparatus consisting of a frame or case divided by partitions and within which a cylindrical sieve, having three or more divisions, is made to revolve at an angle. Thus the Coke may be separated into three or more sizes to suit the wants of different classes of customers. If such a plan were followed, I have no doubt a much more ready sale of Coke would be afforded, and at a price that would prove more remunerative."

One cannot resist the temptation, having read this Paper of well over half-a-century ago, of concluding this Address by observing that, however satisfied we may be as to the positions which the Institution and the Gas Industry have attained, we must bear in mind and be grateful to those who controlled affairs in years gone by. They bore the heat and burden of the day just as we are attempting to do and, although to us their problems may not seem to have been as difficult as we conceive ours to be, they well and truly laid the foundations upon which has been erected a structure of which we may all be proud.

THE TACTICAL USE OF Carburetted Water Gas AS A Coal Gas Auxiliary

by

ARTHUR G. GLASGOW, D.Sc., D.Eng., M.Inst.C.E.,
Chairman of Humphreys & Glasgow, Ltd.



A. G. GLASGOW.

Mr. Arthur Graham Glasgow was born in Virginia in 1865, entering the Gas Industry at the age of 20 with United Gas Improvement Company. The following year he was appointed Secretary and Manager of the Lewiston Gas Company, while in 1888 he became Engineer of the Kansas City Gas Light and Coke Company. Two years later he was General Inspector of Manufacture to the United Gas Improvement Company, and in the following year he received the appointment of General Manager and Chief Engineer of the Standard Gas Light Company of New York. In 1892, when 27 years of age, Mr. Glasgow established the firm of Humphreys & Glasgow in London. He was Chairman of the United States Official Delegation to the World's Gas Congress in Paris in 1900, and Chairman of the Committee on Electrolysis of the American Gas Light Association, 1903-06, while he also represented the American Gas Institute at the Paris International Conference for Standardizing Threads of Gas Apparatus in 1908. He is a Gold Medallist of the A.G.A. and Franklin Institute, and the Author of many patents and papers in gas technology.

The Gas Industry is sometimes described as of two minds in its most fundamental issue—one side being called "gas-minded" and the other "coke-minded." But *all*, of course, are "gas-minded"; while *some* hold that the best way to help gas is through broader marketing of gas-coke.

On the other hand, domestic sales of coke, achieved through additional expenses for conditioning and marketing, tend to deprive gas of its most logical field of usefulness—and without gas there would be no gas-coke. In short, *wise* "coke-minded" policy will not result in substitution of coke for gas, but in extension of the use of gas.

Residual gas-coke must remain a crucial problem as long as its quantity is wholly controlled by the demand *for gas*, instead of for gas-coke, and as long as gas-coke and gas are competing for the same uses. So I myself am striving to cheapen gas, not only by direct means, but especially by *the elimination of those adverse conditions;* for the two most fundamental advantages of Auxiliary Carburetted-Water-Gas are—(*a*) Cheap Peak-Load Gas Production, and (*b*) Economic Control of Coke Production.

The main problem, therefore, in the Tactical Use of Auxiliary Carburetted-Water-Gas is to co-ordinate these unique advantages, so that they may be jointly realized to the fullest extent.

To this end I am urging the use of Auxiliary C.W.G. in accordance with a definite plan, broadly predetermined by normal seasonal variations in the demand for gas, and less controlled by current fluctuations in the demand for coke—which may be reasonably compensated by corresponding variations in coke storage, when the appropriate percentage of summer C.W.G. has been determined.

Such methods, when practised as I shall presently submit, should compose any differences of "gas-minded" and "coke-minded," to the permanent satisfaction of both.

I

(1) The first consideration, and it is strategical rather than tactical, is the relative capacity of the Auxiliary Carburetted-Water-Gas Plant. This is, of course, a local question, and depends *inter alia* upon the relative manufacturing costs of Coal-Gas and Carburetted-Water-Gas, both for base-load and for peak-load purposes. But these purely manufacturing costs are greatly changed by the differences in capital and maintenance charges, which become very large indeed when applied to the peak-load portion of the output and to plant in reserve.

(2) When, as is often the case, Carburetted-Water-Gas—disregarding capital charges—can be made *per se* as cheaply as Coal-Gas, mere arithmetical considerations of £ s. d. would indicate complete gasification of the raw coal—making *all* residual coke into C.W.G. of town quality, with maximum saving in capital charges. But I shall begin at the other extreme, and take the smallest annual proportion of C.W.G. which enables its benefits to be substantially realized—say, 20 per cent. of the annual output.

This strategical question of capacity is greatly influenced by the Tactical Use of the Auxiliary C.W.G. Plant, especially by the co-operation of the Coal-Gas Works with the C.W.G. Plant during the season of heavier outputs—which brings me to the little treatise on "Carburetted Water-Gas as a Coal-Gas Auxiliary," published by Humphreys & Glasgow in August, 1933.

(3) I need not tax your patience with confirmation of the analyses and conclusions therein; for my friend Richards has already afforded us ample opportunity to say all that was wanting in this respect. (Parenthetically, I blame myself for not having made it more abundantly clear that this H. & G. treatise does *not* uselessly compare the impractical construction *in one impulse* of two independent Gasworks of 20 millions daily capacity—one for Coal-Gas *per se*, and the other having Auxiliary C.W.G. Plant; but, on the contrary, seeks (*inter alia*) to establish, for normal comparison, the capital costs of the respective *increases*, when a completed Coal-Gas Works *per se* of 10,600,000 daily capacity grows, in the one case by normal accretions of coal-gas works, and in the other case by normal accretions of Auxiliary C.W.G. Plant, to a capacity of 20 millions daily.)

(4) The Chart attached to this H. & G. treatise shows how the annual output may be advantageously distributed between Coal-Gas and C.W.G. Unfortunately, I have no reproduction of this Chart large enough for general exhibition; but individual copies are in your hands, and I hope these observations may induce you to review the whole treatise and its subsequent discussion.

(5) The Chart shows that—

The total annual production is 4,000 millions, of which 800 millions (or 20 per cent.) are C.W.G.

The maximum week is just double the minimum week;

In the summer period, the minimum Coal-Gas production is 50 millions weekly for 16 weeks;

During this summer period, the C.W.G. averages 13 per cent. for the minimum week, and 21 per cent. for the maximum week;

In the winter period, the Coal-Gas Works produces its maximum of 74 millions weekly for 15 weeks;

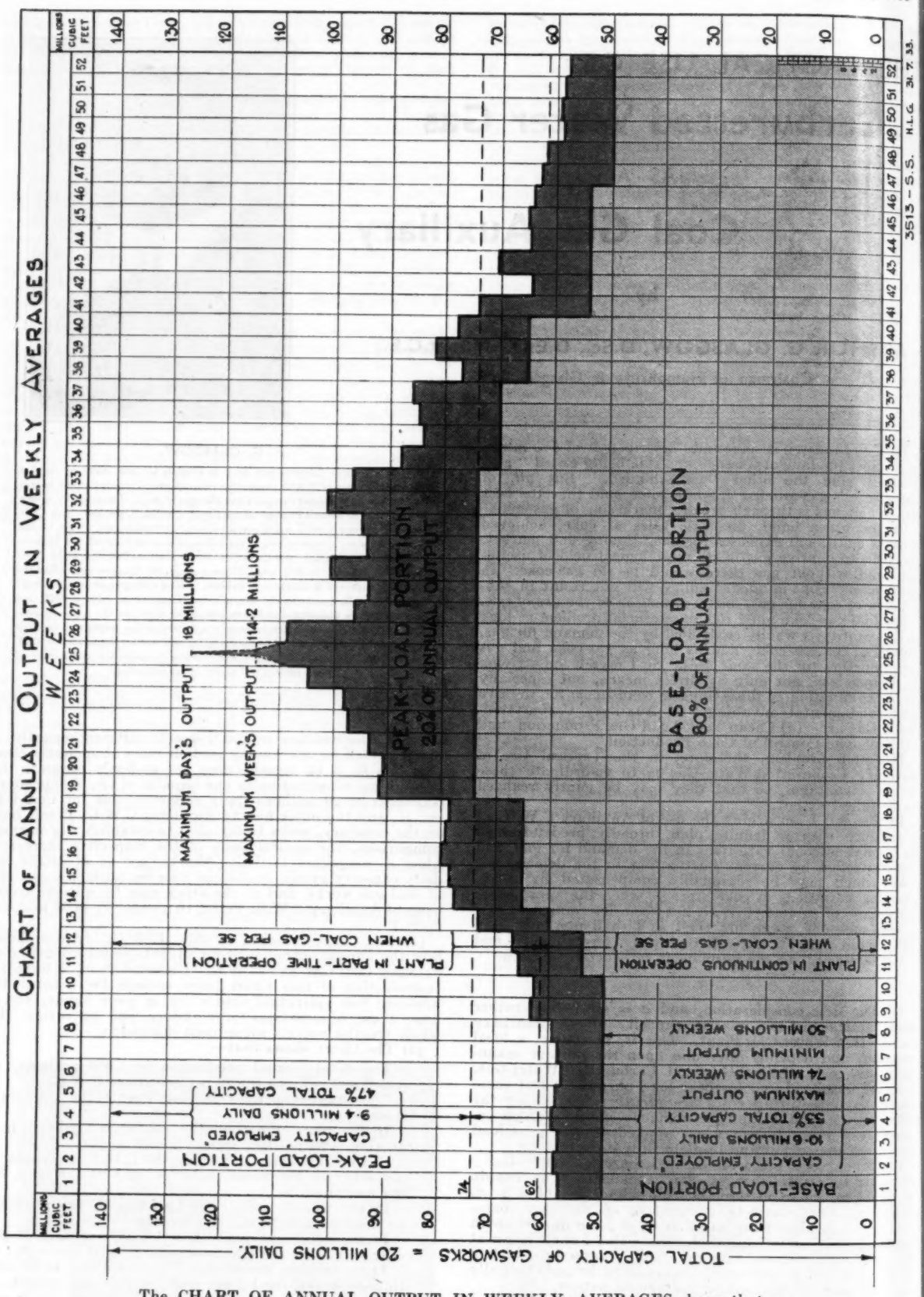
In the maximum week, the C.W.G. averages 35 per cent., while on the maximum day it is 41 per cent.;

The minimum use of any Coal-Gas Plant is 15 continuous weeks, for 1·5 per cent. of the total output.

The Chart also shows that two-thirds of the Coal-Gas Works operate at full load continuously throughout the year, and that all of the remaining one-third is brought into gradual use in the eight "winter" months, to co-operate with the C.W.G. Plant in its far greater Peak-Load Duties.

There is no idling with any Coal-Gas Plant; when once any block is ready for use, it works at full load until shut

(*Continued on page* 735.)



The CHART OF ANNUAL OUTPUT IN WEEKLY AVERAGES shows that—

(*a*) The total annual production is 4,000 Mn. cu.ft. of which 800 Mn. cu.ft. (20 per cent.) are Carburetted Water Gas.

(*b*) The maximum week is just double the minimum week.

(*c*) In the summer period, the minimum Coal-Gas production is 50 Mn. cu.ft. weekly for 16 weeks.

(*d*) During this summer period, the Carburetted Water Gas averages 13 per cent. for the minimum week, and 21 per cent. for the maximum week.

(*e*) In the winter period, the Coal-Gas Works produces its maximum of 74 Mn. cu.ft. weekly for 15 weeks.

(*f*) In the maximum week, the Carburetted Water Gas averages 35 per cent., while on the maximum day it is 41 per cent.

(*g*) The minimum use of any Coal-Gas Plant is 15 continuous weeks, for 1·5 per cent. of the total output.

(*h*) Two-thirds of the Coal-Gas Works operate at full load continuously throughout the year.

(*i*) Nevertheless, one-fifth is shut down six months every summer—for re-conditioning.

own for the year. Nevertheless, the disposition on the Chart provides for one-fifth of the Coal-Gas Plant to be shut down six months every summer for reconstruction.

(6) By means of the tactics illustrated in this Chart, with only 20 per cent. of C.W.G. in the annual output, the saving in capital and maintenance charges is spread over 47 per cent. of the total gasworks capacity, including 10 per cent. reserve plant; while the extreme variation during the year in the weekly average of C.W.G. is from 13 per cent. to 35 per cent., the maximum day's percentage rising to 41 per cent.

The H. & G. treatise establishes the *direct* financial saving due to this tactical use of Auxiliary C.W.G. shown in the Chart, and my present argument is based on that case. I quote Conclusion 5 to Part I of this treatise:

> "Apart from the large 'reflex' benefits (in the purchase of gas-coal and sale of gas-coke and tar), the *direct* savings in this one gasworks, due to substituting only 20 per cent. of C.W.G. for Coal-Gas as described herein, amount to £42,360 per annum"—

equivalent to 12·7d. per thousand cubic feet of C.W.G. produced. Of this amount, the saving in capital charges represents £23,560—equivalent to 7·1d. per thousand C.W.G.

Such, in brief, is the reward for the wise Tactical Use of Auxiliary Carburetted-Water-Gas, as expressed in this Chart. It goes without saying that we cannot expect corresponding benefits in other cases, *unless similar requirements of properly determined local charts are equally fulfilled.* I therefore urge the effective use, by all concerned, of ways and means exemplified in this Chart.

(7) Duplication of capital investment, through overlapping of Coal-Gas and C.W.G. capacity, presents the only real difficulty in this respect; because it requires amortization of Coal-Gas Plant and/or increasing output of gas for its elimination. Although any duplication of capacity is wasteful while it lasts, some initial overlappng of Coal-Gas and C.W.G. capacity is usually unavoidable, if one is to enjoy immediately the full benefits of Peak-Load C.W.G. Obviously, the extent and duration of such overlapping affects correspondingly the saving in capital charges; but initial C.W.G. capital may be greatly reduced, by utilizing for C.W.G. production the displaced Coal-Gas Plant which is common to both processes.

Having minimized the C.W.G. investment, it only remains to stimulate gas sales until the increased consumption of gas and the dereliction of Coal-Gas Plant absorb all duplication of capacity. The ultimate saving in capital charges is then realized—to cheapen the price of gas and further stimulate gas sales.

(8) Taking normally steamed coal-gas at ·45, the maximum range in specific gravity of the properly mixed town-gas is about ·05—which is practically negligible. If the district pressures are correspondingly increased, as they should be in order to maintain the same consumption per appliance, the superior combustion qualities of water-gas due to its CO, and its purer products due to comparative absence of sulphur (about one-fifth of that in purified coal-gas), will substantially improve the service and add to the general satisfaction of consumers. "Overpulling," on the contrary, loads the town-gas with heavy inerts in varying percentage. This practice not only disturbs combustion, but, broadly speaking, is economically unsound. Even if temporarily expedient, pumping, cooling, purifying, measuring, storing, and distributing inerts to consumers would be like increasing ocean travel by housing, feeding, and transporting "stowaways" to destination. In a modified sense, this applies to any dilution of coal-gas.

(9) Moreover, C.W.G. has a "hidden" advantage over Coal-Gas, in its smaller difference between gross and net calorific values. Practically, this difference is a total loss. Hence, C.W.G. of 489 B.Th.U. is the actual equivalent of Coal-Gas of 500 B.Th.U.

(10) The residual coke for sale, in this case, approximates 48,000 tons in the winter half-year and 38,000 tons in the summer half-year. If this summer coke is embarrassing, the percentage of summer C.W.G. may be increased at will, without change in the saving of capital charges; but, excluding capital charges, such additional summer Peak-Load C.W.G. would cost a penny per thousand more than the cheapened Base-Load Coal-Gas which it displaced.

This ends the first portion of my remarks.

II

(1) The prosperity of Great Britain rests on her coal reserves—almost her sole source of heat. It seems, therefore, a national duty to utilize all constituents of this coal with the utmost efficiency; and not burn raw coal in domestic grates and stoves, which require initial lighting and incessant attention, over-heat or under-heat the room, waste most of the heat and all of the "by-products," befog and pollute the air, and defile the home.

(2) Gas, on the contrary, with clean, healthful and definite response to effortless control, is the perfect medium for heating and ventilating, and for cooking and refrigerating. It is smokeless, ashless, labourless, and requires no local storage. It is absolutely reliable. Its scientific manufacture in modern gasworks conserves, with the highest efficiency, all of the other derivatives of coal; the opposite is true of steam-generated electricity.

Moreover, its use relieves congested streets of the distribution of coal, coke, wood and oil, and of the collection and disposition of ashes and clinker—as well as of the obstruction (and mess) caused by this unloading and loading. In short, it substitutes efficient mass production, at the source, for the most wasteful, troublesome and objectionable tasks of domestic life and service.

Eventually, therefore, Gas should wholly supersede raw coal and largely supersede other fuel—solid or liquid—for all domestic purposes. Gas utilization appliances are being vastly improved in efficiency, durability, appearance, convenience and effect. All now use gas; why not more gas? It is only a question of cost; the great desideratum is—*Cheaper Gas!*

(3) There is, however, no way of substituting gaseous for solid fuel in Great Britain, except by the more complete gasification of coal; and conversion of residual coke into blue-water-gas correspondingly reduces the quality of the town-gas—while providing no proper peak-load economies. Cheaper town-gas cannot be achieved by reducing its present standard quality, because capital and maintenance charges are measured by quantity and not by quality—by volume and not by therm. So any reduction in quality correspondingly increases the capital and maintenance costs per therm—of manufacture (possibly qualified by abnormal steaming),* storage, distribution and utilization.

(4) In coal-gas manufacture *per se* (with appropriate steaming of vertical retorts), the production of coke is solely dependent on the demand *for gas*, and has no relation to the demand for coke. Auxiliary Carburetted-Water-Gas, by enabling gas-coke to be made into town-gas, controls the quantity of surplus coke, limits the saleable supply to its most profitable demand—and prevents its "unfair" competition at times with coal *and gas*.

This admixture of oil-gas with the coke-gas, in the form of Auxiliary C.W.G., is the only practicable way—and a perfect way—to maintain both the quality and the peak-load quantity of town-gas, as well as the price of gas-coke, whatever the increase and variations in the demand for gas!

(5) During the five years 1929-1933, less than 1¼ per cent. of pure oil-gas (of, say, three-fold heating value) was in the town-gas distributed in Great Britain. This small admixture of oil-gas, in the form of 14 per cent. of Auxiliary C.W.G., not only enabled 4,000,000 tons of gas-coke (resulting from coal-gas manufacture) to be made into town-gas of standard quality, but also reduced the make of gas-coke by 5,370,000 tons. This 1¼ per cent. of oil-gas, therefore, caused the elimination of 9,370,000 tons of gas-coke, which must otherwise have been sold—at some price—in competition with coal *and gas*, if no Auxiliary C.W.G. had been used during these five years. In 1926, the year of the great coal strike, when the admixture of Auxiliary C.W.G. reached its maximum of 22 per cent. and maintained the quality and quantity of all town-gas services, only 2·3 per cent. of oil-gas was used!

All this was accomplished in addition to peak-load savings equivalent to 12·7d. per thousand C.W.G. produced.

(6) It should be noted that, while the uses of Auxiliary C.W.G. (and payment of gas-oil duty) are confined to Undertakings large enough for the two different processes of gas production, all "reflex" benefits in the purchase of gas-coal and sale of gas-residuals (due to the conversion of residual coke into C.W.G.) are shared by the whole Gas Industry; and that the furtherance of gaseous instead of solid fuel is enjoyed by the whole urban population.

(7) The financial appraisal of these "reflex" benefits in the purchase of gas-coal and sale of gas-residuals (due to increased gasification of the coal by converting its residual coke into Auxiliary C.W.G.) is more a question of comprehensive judgment than of precise accounting. Part II of the H. & G. treatise suggests £2,585,000, equivalent to 15·2d. per M of C.W.G. produced, as their recent yearly value. This is based on saving 1s. per ton in the purchase of gas-coal and gaining 2s. 6d. per ton in the sale of gas-coke and ¼d. per gallon in the sale of tar. Cut these figures in half, and such "reflex" benefits would still exceed the great

* Excessive steaming of vertical retorts (beyond the economic rate contemplated in the H. & G. treatise) may qualify this, in respect of such carbonizing plant only.

saving in capital charges already discussed—which is 7·1d. per M of C.W.G. produced!

Conversely, if any "coke-minded" policy should now add this quantity of coke to the residuals market, it would correspondingly sacrifice these savings.

(8) In general support of these estimates, I may quote the evidence of that distinguished Authority, the Chief Engineer of the Gas Light and Coke Company ("GAS JOURNAL," December 11, 1929, page 725):

> If all the gas manufactured last year for town purposes had been coal-gas, there would have been 11 million tons of coke and breeze for disposal; but, due to the manufacture of carburetted-water-gas, the actual quantity for disposal was only 7,700,000 tons.
>
> It was not difficult to forecast what would have happened if this extra quantity of coke had been placed on the market. The coke market would have slumped enormously, and the price of gas would have had to be increased greatly in order to balance the reduced revenue from coke. From this point of view it was difficult to estimate how great was the value of carburetted-water-gas plants.

(9) I shall conclude this second portion of my remarks by summarizing the preceding discussion:

> (*a*) The Auxiliary Use of Carburetted-Water-Gas affords the only ways and means of substituting gaseous for solid fuel in Great Britain. It not only enables the gasification of raw coal to be continued until it becomes more profitable to sell the still remaining coke *as coke*, rather than as gas, but it also provides—on tap so to speak—peak-load gas at three-fifths the cost (including capital charges) of equivalent Peak-Load Coal-Gas;
>
> (*b*) The *direct* financial savings due to only 20 per cent. of Auxiliary C.W.G. (as appraised in the H. & G. treatise) amount to £42,360 annually, being 12·7d. per M of C.W.G. produced; and
>
> (*c*) The "*reflex*" benefits in the purchase of gas-coal and sale of gas-residuals possibly equal £2,500,000, or 15d. per M of C.W.G. produced. If we credit Auxiliary C.W.G. with only one-half of these "reflex" benefits, it brings the total savings to over 20d. per M of C.W.G.—slightly more than the total cost of the C.W.G., including capital charges!

(10) With such possibilities in view, and with the present crying need for *cheaper gas*, who will lightly reject the Tactical Use of Auxiliary Carburetted-Water-Gas which I have described? Indeed, a small admixture of enriching oil-gas with otherwise unsaleable coke-gas—in the form of Auxiliary Carburetted-Water-Gas scientifically utilized—may well be the narrow key-stone in a broad arch on which rests the future of the Gas Industry.

III

(1) Finally, let us consider the new duty on heavy oil, which (with the uncertainties it creates) is discouraging realization of these great benefits, to far greater extent than the actual amount of this duty—some £220,000 per year.

Exemption, from this new duty, of gas-oil used exclusively in the manufacture of town-gas, far from being unfair to any other domestic fuel, would only tend to restore fair-play between Gas and all other domestic fuels. Because all other fuels (although paying no duty) are protected from oil competition by this duty; whereas the oil used in the manufacture of gas has to pay the duty and compete with both oil and domestic fuels—and with Electricity!

(2) Moreover, the price of coal, on the average, follows the base price of coke—or *vice versa;* so there seems little more reason to expect higher coke prices, in return for payment of this duty on gas-oil, than to expect higher coal prices without any payment. Therefore, when this new duty realizes its primary purpose and increases the use of coal (as all good citizens desire), the corresponding benefit in the sale of coal may neutralize the benefit in the sale of coke. Gas would then, in effect, be collecting any benefit the duty might bring to gas-coke, in order to pass it on to gas-coal; while paying the full duty on oil used in the manufacture of gas—which must be sold in competition with coal, coke and electricity, none of which pays the duty. In modern lingo, Gas would then be "left holding the baby"!

(3) This modest use of oil-gas, by greatly reducing the cost and improving the conditions of coal-gas manufacture, must ultimately benefit the coal industry itself—through furthering the efficient utilization of raw coal in the form of gaseous fuel, while conserving to the utmost all of the valuable by-products of coal.

(4) And is any better way conceivable of competing with foreign oil than to utilize the merest modicum of such oil to further the general use of Gas, in place of liquid or solid fuel, and thus achieve far better and healthier utilization of raw coal for all domestic and many industrial purposes?

Is any better plan possible, in national economy, than to utilize a minute proportion of foreign raw material, like gas-oil, for home profit far greater than the total cost of this gas-oil, while encouraging reciprocal trade with the countries supplying this raw material?

(5) There is another and vital consideration concerning this uneconomic incidence on Gas of heavy-oil taxation—namely, the desperately unfair competition to which Gas is now being subjected, through the operation of the Domestic Two-Part Electricity Tariff. Wherever this subtle Two-Part Tariff obtains, no juggling with gas tariffs can alter this fact: *All Gas must be sold in competition with Electricity's minimum rate*—about one-eighth of the price it continues to receive for its previous lighting supply. The Grid System may tend to subsidize this amazing situation.

(6) In short, every consideration—whether constructive or competitive—amply justifies the exemption of gas-oil, used exclusively in the manufacture of town-gas, from this new duty on heavy oil. From all points of view, it seems clear that National Interests would be far better served through the Gas Industry by remission of this gas-oil duty than through the Exchequer by its collection.

Vote of Thanks

Mr. HENRY WOODALL, J.P.: I have the very greatest possible pleasure in proposing a vote of thanks to Dr. Glasgow for his most able and stimulating lecture. I asked our President to allow me this privilege, and he has very kindly granted my request. I asked it for many reasons, but it will suffice if I mention two. In 1890 Dr. Glasgow came to this country, and I believe the first professional visit he made here was to my office in Palace Chambers, Westminster. I suppose, therefore, that I was the first English gas engineer that he met. Another reason is that I believe my firm was almost the first, if not *the* first, to erect carburetted water gas plants in Great Britain. During the period of nearly 45 years in which I have known Dr. Glasgow I have held him in increasing respect as an engineer and as an original thinker. I also hold him in increasing regard as a friend. The advent of carburetted water gas in this country was an important event in the history of gas manufacture. Carburetted water gas is of the greatest possible use to the Gas Industry as a whole. I suppose the two most important things which it did for us were, first, that it helped us to control and stabilize the coke market, and secondly, that it robbed our peak load of many of its terrors.

Someone who was speaking to me recently said that within a very short time none would be satisfied unless he could obtain his light and heat by either turning a tap or pressing a button. I think there is a good deal of truth in that, and I think we shall also agree that it is the consummation we should wish for. Dr. Glasgow has told us in his lecture how he thinks this can be accomplished. Knowing his very wide knowledge of gas manufacture and distribution in Great Britain, America, and throughout the world, and also his capacity for logical and clear expression, we shall certainly do him the compliment of considering his arguments very carefully. I understand there is to be no discussion of the lecture here to-day, but I am quite sure that it will be discussed very fully by gas engineers and gas administrators throughout the country.

I have the very greatest possible pleasure in proposing a most hearty vote of thanks to Dr. Glasgow for his useful, instructive, and perhaps a little provocative lecture, which we have all greatly appreciated and enjoyed.

Mr. JOHN TERRACE (Past-President), seconding, said: It is a great personal pleasure for me to be allowed to second the vote of thanks to Dr. Glasgow for his interesting and instructive lecture. Many of the older members will recollect that for a number of years I was in the employment of his firm, Humphreys & Glasgow, as a Constructing Engineer and a very happy time it was. It was also largely through Dr. Glasgow's influence that I got my first appointment with a Gas Undertaking—namely, when I became Assistant Engineer to the Tottenham Company in 1902.

This being a lecture there will be no discussion, but I would like to make two points. First, in my opinion the most important thing for the Gas Industry to-day is to sell

more gas. More per consumer to existing consumers and more for other purposes than that for which it is at present used. This, I believe can only be done by a change in the method of charge. It behoves the executive officer of every gas undertaking to make a careful analysis of the returns from the consumers, and devise a scheme of charging which will encourage fuller use to be made of our product, and eliminate if possible the unremunerative consumer. It will be noticed that it is first necessary to make a study of the conditions and then to formulate a scheme, and this brings me to the second point. The next most important thing for the Gas Industry is to make gas as cheaply as possible, and Dr. Glasgow has shown us how the "tactical use" of carburetted water gas may be very different from its "haphazard use." Again, it is essential to study the conditions and formulate a scheme. In gas undertakings to-day, manufacture is carried on with very high efficiency, and most engineers have arrangements to keep them informed of their running costs, while the analysis of the annual accounts as a guide is a familiar part of their training and practice. The lecturer to-day has shown us how various factors affect these running costs and that by planning the combination of various types of plant great economies may be effected. It has been a most interesting and enjoyable lecture, and when the report of it is published I am sure it will be carefully studied by those who have listened to it as well as by others, in each case with much profit.

I crave the President's indulgence for having exceeded somewhat the bounds of my instructions and close by most heartily seconding the vote of thanks.

Mr. W. GROGONO (Croydon), supporting the vote of thanks, said: I am sure that the Gas Industry is indebted to Dr. Glasgow and the firm of Humphreys & Glasgow for all the work that they have done in connection with carburetted water gas. I know that we all feel that we would not be quite so safe if we had not plants of this type on our Works to provide for the sudden peak loads which we experience with the ever-changing climatic conditions.

It is indeed extremely comforting to know that with the modern carburetted water gas plant we are able, practically by the turn of a switch, to increase our make of gas by about three million cu.ft. per day for each set. I am quite certain that it has now been definitely proved that a completely automatic carburetted water gas plant is extremely reliable, and the research department of this Institution have also proved it to be a very efficient one.

In connection with Dr. Glasgow's remarks on the question of the revenue from coke and gas sales, it is interesting to note that, in the case of the Company which I have the honour to serve, the revenue from coke in 1885 was 15·6 per cent. of the total revenue from gas and coke, while in 1934, when we were making 26 per cent. of carburetted water gas, this figure was 15·2 per cent. I cannot help thinking that the rising generation will not want to rely on solid fuels for domestic purposes, but will look to various forms of automatic heating (thus eliminating storage and other inconveniences). In this event they will have to turn more and more of their residual coke into gas to meet the requirements of their districts at a price cheap enough to make it really attractive. The public to-day is undoubtedly demanding better quality coke, free from shale and ash, which means that a large additional expenditure is being incurred in cleaning and preparing this fuel.

The vote of thanks was carried with enthusiasm, and

Dr. GLASGOW, responding, said: For any effort that I have made, gentlemen, I am richly repaid by your generous reception.

New Members of the Institution

On Tuesday, June 4, the following were elected to hon. membership, membership, and associate membership of the Institution:

To Honorary Membership.

The President (*ex-officio*) of the International Gas Union and the Presidents (*ex-officio*) of the Gas Associations of America, Australia, Austria, Belgium, Canada, Czechoslovakia, Denmark, France, Germany, Holland, Hungary, Italy, Japan, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, and Yugoslavia.

Glasgow, Arthur Graham, D.Sc., D.Eng., Chairman, Humphreys & Glasgow, Ltd., London.

Macmillan, The Right Honourable the Lord, K.C., LL.D., President, The British Gas Federation.

Price, Wiliam Edward, Honorary Secretary, The Institution of Gas Engineers.

To Membership.

Bamber, Cecil Horace, B.Sc., Engineer and Manager, County Borough of Rochdale Gas Department.

Beard, George Frederick Handel, General Manager, C. & W. Walker, Ltd., Donnington.

Bennett, Charles Somerville, Chairman and Managing Director, Gibbons Brothers, Ltd., Dudley.

Crawshaw, Charles William, Manager, London Office, The Bryan Donkin Company, Ltd., Chesterfield.

Jeavons, Ernest Edwin, Chairman and Managing Director, E. E. Jeavons & Co., Ltd., Tipton.

To Associate Membership.

Brown, James Middleton, B.Sc., Chemist, The Liverpool Gas Company.

Canning, Joseph Herbert, Engineering Assistant, The Newport (Mon.) Gas Company.

Cruise, Ambrose John, Technical Assistant, The Cardiff Gas Light and Coke Company.

Day, Thomas Henry, Assistant Superintendent, Sevenoaks and Tonbridge Works, South Suburban Gas Company, London.

Elsby, Ralph William, Technical Assistant, Borough of Newcastle-under-Lyme, Chesterton Gas Department.

Fillery, Ernest James, Chief Technical Assistant, Newark Corporation Gas Department.

Grealy, Patrick, Engineering Assistant, The Kidderminster Gas Company.

Greig, John Cooper, Technical Assistant, Glasgow Corporation Gas Department.

Griggs, Arthur Robert, Research Engineer, Humphreys & Glasgow, Ltd., London.

Hayes, Thomas, Technical Assistant, City of Leeds Gas Department.

Keeble, Kenneth Frederick, Assistant Works, Engineer, Primitiva Gas Company of Buenos Aires, Ltd.

Knight, John Voughton, M.A., Engineer and Manager, The King's Lynn Gas Company.

Law, Joseph Edmund, Assistant Industrial Representative, South Metropolitan Gas Company, London.

McManus, James Ernest, Assistant Works Manager, Howdon Works, Newcastle-upon Tyne and Gateshead Gas Company.

Newton, William Thomas, Project Engineer, The Woodall-Duckham Companies, London.

Parsons, Robert Edward, Shift Superintendent, Warrington Corporation Gas Department.

Rees, Kenneth Charles, Technical Assistant, Wandsworth and District Gas Company.

Scott, David Walter Graham, Junior Engineer, Birmingham Corporation Gas Department.

Shackleton, Henry, Technical Assistant, The Grantham Gas Company.

Smith, Ebenezer Gelfillan, Chief Technical Assistant, Royal Burgh of Dumbarton Gas Department.

Stamper, Thomas, B.Sc., Pupil Engineer, The Gas Light and Coke Company, London.

Stevenson, Edgar William, Assistant Chemist, City of Leicester Gas Department.

Stonham, Bernard, Assistant Engineer, East Hull Gas Company.

Stothart, James Dunlop, Assistant Continental Engineer, West's Gas Improvement Company, Ltd., Manchester.

Taylor, Norman Richard, Technical Assistant, Smethwick Corporation Gas Department.

Tilley, John Geoffrey, Technical Assistant Halesowen Gas Company.

Tunstall, Richard Brian, M.Sc., Technical Assistant, Tottenham and District Gas Company, London.

Turner, George Oscar, Assistant Chemist, The Croydon Gas Company.

Walsh, John Bernard, Technical Assistant, Altrincham Gas Company.

Westwood, Reginald Albert, Technical Assistant and Chemist, Oldbury Urban District Council Gas Department.

Elections to Associateship are recorded on another page.

DISCUSSIONS ON THE PAPERS

Our report of the Papers appeared in our First Institution Number, and the following is a full report of the Discussions which took place upon them. Papers and Discussions are summarized on earlier pages of this issue in the running account which gives the consecutive story of the whole Meeting.

NATIONAL POLICIES GOVERNING The Testing of Gas Appliances

By STEPHEN LACEY, B.Sc., M.Inst.C.E.,
Controller of Gas Sales,
AND
C. A. MASTERMAN, M.A., F.I.C.,
Chief Technical Officer, Watson House, Gas Light and Coke Company

Mr. H. C. SMITH (Tottenham): Mr. Lacey and Mr. Masterman, as was to be expected, have given us something to think seriously about in the Paper which Mr. Lacey has just introduced in his usual admirable manner. During the past few years in which visits of Gas Engineers abroad and particularly to America have been frequent many favourable opinions have been expressed concerning the American Gas Association Testing Laboratory. At first blush, the natural tendency is perhaps to assume that because America and some other countries have established some form of national testing the manufacture of appliances has therefore reached a higher standard of efficiency and safety in those countries than in our own. The Authors of this Paper, however, make it convincingly clear that this is not the case, and they pay well-merited tributes to British manufacturers of appliances for the efficiency, safety, and high standards generally to be found in the goods they market. It is particularly interesting to read that "there are few appliances which conform to the commonly accepted standard of the larger undertakings or appliance manufacturers which would fail to pass the official tests in other countries, but many appliances fulfilling overseas standards would be considered unacceptable in Great Britain," and further that "had the Gas Industry in other countries been as well served in appliances and technique as we ourselves at the present time it is extremely doubtful whether in most cases the testing systems would have been set up." These are not the hastily formed views of casual visitors, but are the considered opinions of trained observers well qualified to judge and as such warrant serious consideration in any discussions relating to the advisability of setting up National Testing Laboratories.

The Authors have dealt with the whole question in a most comprehensive manner, and have given at some length the advantages and disadvantages of the various systems of official or semi-official national tests. They have examined the problem thoroughly and have put forward concrete proposals which are designed to prevent any but satisfactory gas appliances being sold or available to consumers. In their view safety considerations alone would scarcely justify an extension of the present system, or as they say lack of system, which has led generally to a high standard in this country. They point out that the hazards from gas in this country are now statistically negligible. Quite obviously in other countries the hazards from gas were so serious that some steps had to be taken in order to reduce those risks to more reasonable limits, and the setting up of some form of national test appears to have been successful in this respect.

Necessary to Look Ahead.

The good work which has been done in this country by the makers themselves and by some of the larger gas undertakings has achieved a similar object without the necessity of imposing a national test. The Authors point out, however, that it is necessary to look ahead and to be prepared for extraordinary competition which is likely to occur between gas and other forms of heating, and it is from the point of view of giving the fullest satisfaction to the consumer that they stress the advisability of taking some steps to improve the quality of gas appliances. The proposals they make are very interesting, and should be capable of practical application. It would be interesting to hear the views of the makers of gas appliances on the suggestion that a certification trade mark should be registered which should be shown on the appliance itself and which would contain the approved B.Th.U. rate per hour for safety for that appliance. I believe that the responsibility for affixing this mark could be left with any reputable maker and that the cases where appliances were sold carrying the mark and being incapable of fulfilling the safety specification would be very rare.

In their suggestions for the formation of panels representing industrial, domestic, illumination, and utilization research technique the Authors are opening up for discussion a very wide subject. I agree with them entirely when they say that The Institution of Gas Engineers is the technical body under the encouragement of which the growing technique of gas utilization could probably best be fostered. The Institution of Gas Engineers is the national technical body of the Industry. It is, perhaps, not generally realized by those engaged in the Industry who are not members of the Institution that the functions of The Institution of Gas Engineers really fall into two parts. On the one hand there is The Institution of Gas Engineers as a professional body financed by subscriptions of members who are qualified as Chartered Gas Engineers. On the other hand the Institution is a body engaged in research and other technical work on behalf of the Industry, which work is financed by the Industry. In connection with this side of its activities the scope of the Institution in technical matters is unlimited. We should bear in mind that so far as professional institutions go it is probably in this way unique. Most of the members of the Institution belong to the other national bodies of the Industry which are non-technical. There is no question, as I see it, of the Institution wishing to keep from its ranks those who may be qualified technically in other directions but not as Gas Engineers. On the contrary, the rules of the Institution provide that those whose work is likely to be of use to the Institution—and this I think might be read as of use in a technical direction to the Industry—may be elected Associates of the Institution; and while I can only speak for myself my own opinion is that the closest possible technical co-operation should be fostered in the Industry by the Institution welcoming as Associates all those who are so qualified. It would be a thousand pities if anyone engaged in the Industry in a technical capacity should feel aggrieved that he was not eligible for Corporate Membership of the Institution and therefore not be willing to co-operate in that technical work which the Institution is carrying out on behalf of the Industry. I mention this in support of the Authors' suggestions that the Institution should encourage the growing technique of gas utilization.

As to whether the suggestions they make for the formation of the four registers or panels covering industrial, domestic, illumination, and utilization research technique

are likely to form the most effective organization for carrying out their proposals I should not like to express any firm opinion at the present time; but these suggestions have I know been made after very serious consideration, and I hope the Council will in due course give them the careful thought they deserve.

From my own observations of the Industrial Gas Development Centres very valuable work has been carried out, but it will be interesting to hear the opinions of some of the members from smaller undertakings who are, perhaps, in a better position to say of what value the work done by these Centres has been to them. In conclusion, I should like to express my hearty thanks to the Authors for their valuable contribution to the proceedings of the Institution.

Consultation of Chemists and Physicists.

Dr. HAROLD HARTLEY: The discussion which the Authors are initiating to-day on the technical organization of the Gas Industry is long overdue. It is Section X of their communication which is most in need of consideration, and not, at this stage, the questions of detail involved in the testing of gas appliances.

The framing of tests of gas appliances necessitates the calling into consultation of chemists and physicists who have the requisite knowledge and experience. Otherwise the decisions reached would not command universal support.

There is, however, in our Industry only one professional body—namely, this Institution—membership of which is limited to the Gas Engineer. There is no organization which represents the chemists and physicists. Were it not for the courtesy extended by this Institution they would not have had a platform from which to ventilate their problems, and I can assure you, Mr. President, that they are not unappreciative of the kindness shown to them in the past. There is, however, a strong feeling that their growing importance to the Industry involves fuller recognition than has yet been given.

At present the consideration of problems of the non-engineering type is not limited to any one body, even within the Industry. For example, some years ago the B.C.G.A. elected a Committee to investigate the question of the relative merits of gas and electricity for cooking. Also they have in existence a Committee considering the future of the flueless gas appliance, these Committees for the most part being composed of technical men who have no engineering qualifications such as would admit them to membership of this Institution. Again in the past, certain chemists and physicists concerned with utilization matters have constituted the majority on panels appointed by this Institution to discuss matters relating to the gas cooker and the gas fire.

Further, there was formed recently by the British Standards Institution a Committee, composed of chemists and physicists employed in the Gas Industry, to discuss and draft proposals for the testing of gas appliances, and to define some standards of performance. Their work is proceeding rapidly.

In the present stage of the organization of the Gas Industry the non-engineering technical questions involved could as well be disposed of by the B.S.I. as by any other. Conditions, however, should not be such that chemists and physicists of our Industry prefer, as at present, to discuss such matters under the ægis of an outside body such as the B.S.I. Is there not really a great gap in the technical organization of the Gas Industry? As an Industry we do not possess a national technical body because a national body must be all-embracing.

How are we to organize and avail ourselves effectively of the services of the majority of people in our Industry who have to deal with technical matters of some kind or another, so that we may effect the three objects referred to by the Authors in the course of the Paper? If we can but organize technical opinion and render it articulate we shall speed up technical progress. One of the disadvantages from which this Industry suffers at the present day is that there is no body which can really claim to represent it on all phases of technical matters. What body can, for example, with its existing authority really tell the Ministry of Health the standards attained in the Industry and the technical objects in view in so far, say, as gas-using apparatus is concerned? Certain of our technical men have in the past had the responsibility in their individual capacity of doing this work, but they have been conscious of the fact that they were not assured that their views were the views of the majority of the Industry, and if broadcast would receive suitable support. These are some of the considerations which indicate the limitations of our present organization of the Industry.

Scientific Background.

I want now to turn for a few minutes to another phase on which the Authors barely touch and ask you to examine the question—What scientific background has our Industry? How does it compare with other great industries as, for example, the electrical industry which is this week holding a large national convention at Bournemouth? Is it realized that the major portion of modern research work in physics is a direct asset to electricity and that every student entering the Physics Departments of our universities is a potential recruit for the electrical industry? What is being done on behalf of the Gas Industry? Of how many scientific men can it be said that they are really associated in the minds of their *confrères*, let alone the general public, with the Gas Industry? How often are our functions graced by the presence of *numbers* of eminent scientific men? What proportion of those engaged in our Industry realize the help that science can offer them? What appreciation does the Industry show of the scientifically-trained men in its service?

Those who are really concerned with the future of our Industry will supply themselves with answers to two questions:

(1) Do they really believe in the application of scientific knowledge and in scientific progress? and

(2) How is advance to be effected?

The future of this Industry will depend on the manner in which it takes advantage of scientific development. It is essential we ensure the proper utilization and welding of the knowledge of our chemists, our engineers, and our physicists. Further, we ought to see to it that an adequate number of those engaged in scientific research in this country is interested in problems which are fundamental importance to the Gas Industry. Then again, how are we to ensure that, of those trained in science in the future, the Gas Industry shall get its share of outstanding men?

What is the Gas Industry as a whole doing in the way of fundamental research? I agree with the Authors that our record is not one of which we have any reason to be proud. Our failure to ensure adequate development on the purely scientific side has affected our prestige. Such small sums of money as are expended in research have generally been devoted to problems of detail. What support is given by the Industry as a whole to laboratories in our universities or technical institutions to ensure that they shall interest themselves in subjects of fundamental importance to us? So far as I am aware only two of our gas undertakings and one of our appliance manufacturers subscribe *regularly* to such work. Is it realized that the body of scientific knowledge is the capital on which industry lives and that we as an Industry are eating up capital and taking no direct steps towards its replacement? How is it that such a state of affairs exits? Is it not a consequence of the method of development and growth of the Industry? We have got ourselves into a series of watertight compartments, and the importance of ensuring adequate representation on the scientific side has been largely overlooked. This state of affairs must be altered if we are to ensure adequate general technical development.

Now, what are the Authors' proposals for putting our house in order? Are they not only suggesting a continuation and extension of an existing system which they themselves really believe has been inadequate? Is not our position sufficiently serious to make us realize that a fundamental change is required and that it will not serve to patch up the existing arrangement? Do the Authors really feel that membership of the proposed research panels would appeal to eminent scientific men outside the Industry? I feel that you will not obtain the best services, even from the chemists and physicists within the Industry, merely by appointing them to panels of the Institution or any other body. They would only be elected as an act of courtesy, and then probably because of the importance of the concern they serve rather than on the basis of ability. They would not be admitted to the parent body as a right, although they would be asked to serve on the panels because they have something to give to the Industry. Under the Authors' proposals they are still to be kept "below the salt." The interest shown by outside scientific people in the work of research panels of the Industry in the past has not impressed one as being conspicuously great.

Spirit of Co-Operation.

I hope the present discussion will lead to a definite development within the Industry, for development is necessary, and if it does not take place with the willing support of the existing organizations it will continue along the line of progress already initiated outside the Gas Industry. The problem, however, will have to be approached in the

right spirit, and a paragraph in the Authors' communication makes me feel they may doubt whether a spirit of real co-operation does exist. I have in mind the paragraph in which a reference is made to the importance of ensuring the ready co-operation of the appliance manufacturers. Is there still such a spirit among us that their remark should be necessary? Have not the appliance manufacturers during the present century at least been responsible for much development on the gas utilization side? Their work may have been inspired by self-interest, but it has been of value to the Industry second to none other. Our Industry will not attain a full measure of success if there is division in its ranks. Technical staffs of firms engaged in the manufacture of gas-making plant or of gas-consuming appliances should only be expected to co-operate fully with others in the Industry on an equal footing. In their own sphere they have probably as much to give as they will receive in return. I am whole-heartedly with the Authors in their belief in the need for organization of our technical members. I join issue with them on the methods they propose for attaining the desired end because I feel their suggestions are quite inadequate owing to their endeavour to link the proposed development with an existing organization.

I do not want my comments merely to be destructive and put forward the following suggestion in the hope that it may prove constructive. We need a technical group which shall embrace on an equal footing all technical men within the Industry who desire to become members. We have to ensure the full utilization of the services of all technicians so as to be representative of technical opinion as a whole. In other words, we are in want of a Gas Institute, the only qualification necessary for membership of which should be *an interest in the technical progress and development of the Gas Industry and full time service within its bounds*—such qualification for membership is not an exacting one. Let us have no nonsense about professional merit. Let the membership be open to all and sundry who have a technical job to do, and ask from them only the payment of a small fee as we want our members to number many thousands.

With such a Gas Institute in existence problems concerned with the testing of gas appliances, standards of performance, labels of merit, and so on, could be dealt with automatically as a part of the main work of the organization. Further, such a representative technical body would enhance the prestige of the Industry and would be more likely to interest the scientific men of the country in the future of our Industry. This development must not be limited to technicians of the gas utilization side; equally do we want to include the technicians of the gas-making side. Each will profit by rubbing shoulders with the other and perhaps then even sulphur will go.

Let me emphasize that my proposal is that this Gas Institute should be concerned solely with technical matters and should not interest itself in matters of policy and other special problems which are better looked after as at present by existing organizations. I hope that like these other organizations the proposed Institute could be brought within the framework of the British Gas Federation.

Fostering the Technical Spirit.

By making membership of the new organization open to all we shall foster the technical spirit throughout the Industry. The proposed Institute would, of course, be controlled by a council which through sub-committees would deal with the various technical problems which need examination. The sub-committees would in their turn report back to the main council, but all recommendations should be considered by the Institute as a whole before they are finally adopted. By such a procedure we should get the best results and offer the best opportunity of ensuring that those who have something of value to say would be heard. The Gas Institute should concern itself with the collation and distribution to its members of technical information of interest to all sections of our Industry. By its aid we should increase the knowledge possessed by the men who, up and down the country, have to expound the possibilities of gas to potential consumers. Men on the sales side would be brought into contact with men on the design and manufacturing side and each would profit. All would feel that they are not merely insignificant cogs in a machine but members of a technical Institute representative of the whole of a great national industry.

May I conclude by complimenting the Authors on their Paper and by appealing to you, Mr. President, and to your colleagues on this Council of The Institution of Gas Engineers, to use your great influence to bring into existence, in this year of Jubilee, such an all-embracing technical body as the proposed Gas Institute.

Dr. C. M. WALTER (Birmingham): The question as to the advisability or otherwise of organizing a scheme whereby gas appliances can be certified either in regard to their safety in use alone, or their safety in use *plus* performance, has been engaging the attention of most of the larger undertakings for many years. I feel sure that all of us who have taken part in these various deliberations were very glad indeed to have the co-operation, assistance, and advice of Watson House in these matters. The Paper before us is most interesting to all engaged in this work, and I am sure the *résumé* of what has been done in other countries is very valuable for reference. In the introduction the Authors state that technical control may be conservatively estimated as representing at least 85 per cent. of the gas appliances sold in this country. I think that that in itself is very illuminating. I am afraid, from my experience in other countries, that the figure would fall very considerably short of 85 per cent. there.

In Part III of the Paper, reference is made to the A.G.A. method of badging, and it is mentioned that the primary object is safety to the user. In any scheme that may be formulated for this purpose I think we should discriminate between safety to the user and performance, because I feel that it is easy to certify an apparatus from the point of view of its ability to pass a safety test, but it may be very difficult if we have to include in the certification any question of performance. I understand also that no attempt has been made in the A.G.A. scheme to grade the apparatus, which either passes or fails. It is very difficult, I think we agree, when we grade apparatus into categories. It might be possible for a temporary certificate to be issued when a piece of apparatus in the development stage is submitted, a final certificate being issued on a sample taken from bulk.

The statement that 99·8 per cent. of all appliances submitted have had to be corrected in some way or other before final approval has been given (under the A.G.A. scheme) indicates how very much this country is in advance of America. It seems extraordinary that such a high percentage of the apparatus tested should have to be rejected.

In Part IV of the Paper, dealing with the German scheme of testing, mention is made of the fact that little co-operation exists between testing authorities. Surely we should find it impossible to launch any such scheme unless all the authoritative testing concerns were in very close co-operation! Again, from the remarks in Part V, dealing with the French scheme, it appears that no mention is made, on the official badge, of the gas rate. I think, however, that it is very important to include this. In Part VIII (Technical Standards) reference is made to improvements in efficiency of appliances in this country, due to the co-operative efforts of the appliance makers and the gas undertakings, and it shows clearly why it has not been necessary in the past to consider this matter of certification.

Use of Mark by Manufacturer.

While I agree entirely with the suggestions as regards certifying in such a manner that the normal rating and overload rating is distinctly marked on the apparatus, I have my doubts as to whether the manufacturer should use the test mark on his own responsibility. Indeed, I think the appliance maker will generally prefer that his appliances should be marked by some authoritative, independent body, and I feel that the public also would call for an independent test. If the badge or other marking refers only to safety in use, and includes, as the Authors suggest, an overload rating, then I think that is all that is required. It will still leave the question of performance to be decided by the user, who can generally attain all he wants: it is generally a question of what he is prepared to pay. I think the most important point is to be sure that the apparatus used passes the safety test.

Mr. T. P. RIDLEY (Newcastle-upon-Tyne): I would like to add my congratulations to those already expressed to the Authors upon their most able Paper upon a subject of the utmost importance which is waiting consideration and action. The certification of appliances, co-operation in testing and the prosecution of research may be judged by considering whether the results are likely to answer in the affirmative the following questions:

Will the result be the highest possible efficiency of appliances?

Will the worst class of appliance be driven off the market?

Will needless duplication of work be eliminated?

Will standardization as far as desirable be attained? and

Will the results be available to all undertakings?

There have been many expressions from time to time that a system of certification similar to that in operation in America should be adopted in this country. I feel that these have been made without the depth of thought and

length of view displayed by the Authors, and that the most important of the objects to which I have referred would not be achieved. I am sure the Authors are right when they say that if as high a standard of appliances had been common in other parts of the world as in Great Britain there would have been fewer certifying organizations. The high standard of appliances in this country is due to the great and genuine desire on the part of gas undertakings to give true service to their customers and to the fact that the gas undertakings have very largely controlled the supply of appliances.

Overlapping of Work.

In my opinion, a certifying system would not be satisfactory in this country because appliances conforming to the minimum requirements would not in many cases be of sufficiently high standard for the progressive undertakings to supply to the public—quite apart from the cost of such an organization. At the same time I feel that there is overlapping at present in the work carried out by industrial undertakings and manufacturers which should be avoided; there should be more agreement as to methods of testing particular classes of appliances and there should be more availability of information. I think the Authors have done the Industry a great service by putting forward framework organizing proposals for overcoming these weaknesses and at the same time not cramping but helping forward progress and efficiency. There would be under the present proposals flexibility and results would be available to all who desired to have them and a still higher efficiency of utilization would be attainable.

The Industrial Technical Committee is doing good work and there are not too many centres, but I doubt whether it is desirable to have as many centres for domestic and illumination work. Better results may be obtained by more limited numbers. The Authors wisely contemplate different treatment for the Utilization Research Committee. I am interested by the idea of specifications concerned solely with the safety of appliances being drafted by the proposed Domestic Technical Committee and finally issued under the ægis of the British Standards Institution, a certification Trade Mark guaranteeing that the appliance so badged conformed to the appropriate specification. I should be much interested to hear if the Authors have formed any idea as to how far this sort of direct specification could be carried so as to contribute substantially towards ensuring the safety of appliances.

A great deal of study of the proposals is necessary by all interested parties to bring them to practical working form linked up with existing organizations, but we have now got something definite to start upon, and I think a highly efficient and economical organization may be evolved. Such a result would be eventually reflected in our sales and in our net revenue accounts.

Research Ever Necessary.

Mr. H. D. Madden (Cardiff): In the first place I should like to say that I realize again what a great debt of gratitude we owe to the Gas Light and Coke Company and to Sir David Milne-Watson for allowing this work to be published. They send information to us whenever an investigation is made, and we really do appreciate it. With regard to the testing of appliances, I agree with the Authors that research is ever necessary—more necessary now than at any time in our history. If we are to make progress in sales, it will be as the result of joint work, of investigation within the gas supply industry, supported by the makers of appliances. We must work together. The work I have done during the past few years in Cardiff has drawn my attention to the latent defects which develop during use. We find that apparatus may be perfectly good when tested in the laboratory, but that after it has been in use on the district for a time, latent defects appear. That is one line of research to which we should direct attention. Again, after the technical tests, there is the question of the domestic test. I apply the word " usability," which indicates that I am regarding the matter from the women's standpoint. If the technicians pass an apparatus as being excellent, I do not think that that should represent the last word; I think that the lady demonstrators, who have the women's point of view, should be called in to give their views, because although the technicians may be satisfied that the apparatus is very highly efficient, there may be points about it to which the housewife would object very strongly. There must be joint work.

Another problem which the Industry will have to face is the sale in shops of cheap appliances—fires, burners, and so on—which, I am sure, do the Industry harm.

The organization for the work envisaged in the Paper should be built up on national lines. We have the Joint co-ordinating Committee, and the Technical Sub-Committee, and I think they should start the framework of these tests. Only by joint working and joint action shall we achieve results. We have to bear in mind also the value of the work to the smaller undertakings, and I do find that these smaller undertakings appreciate the information very much if they can get it. In South Wales and Monmouthshire we have been giving the results of tests to our contributing members; they do appreciate it, and they come to us for a good deal of advice and guidance.

Dr. B. Friedman: I much appreciate the opportunity given to me of saying a few words in connection with the excellent Paper by Mr. Stephen Lacey and Mr. Masterman. I should like to congratulate heartily these gentlemen on the presentation of a most interesting and valuable contribution to a very important subject. I would at once say that I am in complete agreement with most of the views expressed by the Authors. As a manufacturer of gas appliances I am in the happy position of being able to express a very definite and unbiased opinion on the subject of the Authors' Paper, as the introduction of the testing of gas appliances or the continuance of the present conditions will make very little, if any, difference to the manufacturer. In either case, all manufacturers are on an equal footing, and the principle of free competition remains unaffected.

Power to Withhold Gas Supply.

The proposal of testing gas appliances with the ultimate object of marking them with a certification Trade Mark is to safeguard the public from, if I may say so, undesirable gas appliances and to restrict their use. In practice, this will not work unless the Gas Industry is invested with power to withhold the supply of gas unless satisfied with regard to the gas appliance, installation, flue, &c., and has the authority to enforce maintenance. Otherwise, there will always be an opening on the market for manufacturers who would endeavour to compete in price by supplying undesirable appliances. In my estimation 70 per cent. of the supply of gas water heaters is to-day handled by the gas undertakings. This procedure is equivalent to a certification Trade Mark without introducing all the drawbacks of a visible mark. Even assuming that such a grant of power as mentioned above is feasible, it does not exclude drawbacks such as lowering standards, &c., and the many other drawbacks which are clearly outlined in the Authors' Paper. Nor am I in favour of marking the input of the appliance. This will very easily create confusion in the mind of the public and of the trade, both being insufficiently conversant with the object of such marking. Such a mark might easily be taken for a certification Trade Mark.

The application of a certification Trade Mark to gas appliances may facilitate their sale through builders' merchants, plumbers, builders, and ironmongers in the free market. Although at first sight it might appear that this is desirable, since it extends the market of gas appliances, I think at this stage it is opportune to compare the handling of gas appliances on the Continental market, where the certification Trade Mark is in operation. There the position is almost the reverse, as the bulk of the business is done through the traders. As already pointed out in the Authors' Paper, the Continental conditions are different, and I would like to add, they are very different. On the Continent, particularly in Germany, Switzerland, &c., the consumer can avail himself of the services of a highly skilled body of plumbers. There is no such opportunity in this country. Although in this country a body of Master Plumbers is in existence, it cannot be denied that this body is not absolutely in a position to handle the installation, regulation, and maintenance of modern gas appliances, and has not yet gained sufficient experience in the technique of gas utilization. I think that this is the reason why the Gas Industry in this country has been compelled to take the control of the situation into its own hands. The present-day installation methods on the Continent are the result of a long experience extending over several generations.

Another explanation, perhaps the more important one, as to the reason why the German Gas Industry was so interested in introducing the testing and hall-marking of gas appliances is that the plumbers (Installationsgeschaefte) sell, install, and maintain the bulk of the appliances. The Gas Industry has very little and sometimes no control whatever. It feels that the introduction of the test standard brings it into the picture and gives it a measure of control. It is too early to estimate the value of the introduction of the test standard in Germany.

Undesirable Consequences.

In this country, the public has been educated to seek advice and guidance from their local Gas Undertaking and to purchase from the Gas Company the appliances they require. The introduction of a certification Trade Mark

would, in all probability, alter this policy, and in view of the afore-mentioned difficulties with regard to installation, &c., and also in view of the very keen competition to which the Gas Industry is now being subjected, any experiment of this nature in this country may have very far-reaching, undesirable consequences.

From my experience, I can say that of every 100 appliances sold to the trade, nearly every one has been a cause of complaint for reasons which have already been referred to. This experience has been so alarming that we have, as far as possible, pursued the policy not to supply the trade direct. We are satisfied that the provision of a certification Trade Mark will serve no useful purpose but may do considerable harm.

The interests of the supplier of gas and the gas consumer are in many respects the same, and it is evident that the gas supplier is in a much more favourable position to safeguard the interests of the consumer, which, after all, are his own interests. It would, in my view, be of great advantage and assistance to the smaller gas undertakings if a schedule of methods of testing could be drawn up for their guidance. It cannot be too strongly emphasized that co-operation between the Gas Industry and the makers of gas-consuming appliances is desirable, as pointed out in the Authors' Paper, and some such arrangement is already overdue.

Broader Issues.

Mr. PERCY GOODE (British Standards Institution): This discussion is becoming of very great interest to the Gas Industry. But I should like to add my tribute to the Authors from the point of view of the rather broader issues the existence of which they have recognized. I think the broader issues, to which they have referred briefly, can perhaps be described as the growing recognition in an industry of the need for giving proper and effective protection to the purchaser. I am placed in such a position that I can see this trend in a number of industries. It is a trend which began, of course, many centuries ago in the granting of certification marks. In recent years a number of industries have recognized that, whereas in the past the ordinary purchaser was able to determine the quality of the goods by looking at them, tasting them, and smelling them, to-day he needs something very much more elaborate; he needs some sort of definite specification or definition of what is a reasonable quality and what is not.

In regard to this matter of certification marks for gas appliances, I do not believe you can confine the requirements solely for safety. It is *permanent* safety rather than just safety that is requested, and that involves various other considerations. Again, speaking from my experience of witnessing the development of this sort of work in a number of cases, it is essential that the requirements should be arrived at by agreement between the manufacturers, the users, and the scientific and technical people. One speaker has urged that the scientific man should not be below the salt. I do not believe that in this Industry the scientific men are below the salt in these discussions. I believe you have passed the stage at which the practical man, so-called, had his own way. Benjamin Disraeli's definition of a practical man is "One who practises the errors of his forefathers." In all the specification work that I have seen in the Gas Industry, the utmost attention is given to scientific matters.

I am glad that the Authors referred to the need for the standards to be written down, so that they should not be merely matters of discretion. It is enormously important that if you are to have standards for certification they should be written down, so that all can see them. In a recent decision in the House of Lords, Lord Tomlin quoted a very old requirement—and with approbation. It was to the effect that it was not desirable to depend upon the uncertain and crooked cord of discretion, but rather that we should depend upon the golden and straight metewand of the law. That supports strongly the point the Authors have made as to the necessity for writing down whatever requirements are agreed upon.

In this question of certification marks of quality I should like to urge the consideration of maintaining co-operation with all industries which are carrying out this work.

PROBLEMS AND ANSWERS IN

The Reconstruction of Manufacturing and Distribution Plant at Nottingham

By GEORGE DIXON,
B.Eng., Assoc.M.Inst.C.E.,
Engineer and Manager of the City of Nottingham Gas Department

The PRESIDENT: Mr. Dixon has said that he would make no apology for having dealt in one Paper with the modernization of carbonizing plant and also with the distribution department. He referred also to the fact that I asked him to submit a Paper; and I make no apology to you for having asked him to deal with both subjects. Knowing how well he would deal with them, I assured him that the Institution would welcome such a Paper, and I am sure that those who have read the Paper will feel that I was right.

Mr. R. E. GIBSON (Liverpool): We are indebted to the Author for the very full information he has given of his reconstruction scheme at Nottingham. Many engineers are faced with the problem of replacing obsolete plant, and this Paper contains information which will be exceedingly helpful to those who have to deal with such problems.

There are several points on which difference of opinion will arise. Many will disagree with the Author's view that the risk of failure of coke oven supplies is no greater than the risk of a similar failure from gas works. There is one reason at any rate why coke oven supplies are less dependable. The men employed on coke ovens belong to the same union as the coal miners and would be affected to the same extent in the event of a coal dispute. The past history of the coal industry is not very reassuring on this point. It would seem that there is good reason why users of coke ovens should make adequate provision against possible stoppage.

The remarks of the Author regarding the properties of coke from Nottinghamshire coal are fully borne out by a series of tests at Liverpool in connection with the production of special smokeless fuel. The moisture content of the coke is given as 6·26 per cent. in the Paper. This percentage may be satisfactory for ordinary coke, but judging from our experience at Liverpool it is too high for easy ignitability in the domestic grate. There should be no difficulty, however, in obtaining under 2 per cent. in the plant installed at Nottingham. It is unfortunate that many of the Nottinghamshire fuels contain so large a percentage of inherent moisture, reducing the thermal yield per ton considerably. This moisture is apparently responsible for the high percentage of volatile matter shown in Table 2.

The Author evidently intends to give the new plant the full benefit of working at full capacity all the year round. This can only be done by shutting down other plant which will consequently suffer by comparison of results. The ideal arrangement would be to have units of plant of such size that they could be closed down in complete sections so that labour charges could be reduced proportionately.

The Author's desire to improve the outward appearance of the retort house is commendable, but he has not got away from the steel-framed building; he has embellished it. Many will agree with him that the extra cost involved is justified. It seems to me that cathedral-like buildings are rather out of place. There is certainly much to be said for covering the steel framework by brickwork to eliminate painting as far as possible.

Renovation of Appliances.

Attention is directed in the Paper to a side of the gas business that has not hitherto received the attention it deserves—viz., the arrangement of workshops to deal with the renovation of gas appliances. This matter must be engaging the attention of many gas engineers to-day. In many towns large quantities of old black cookers are being brought in and replaced by all-enamelled cookers. After a

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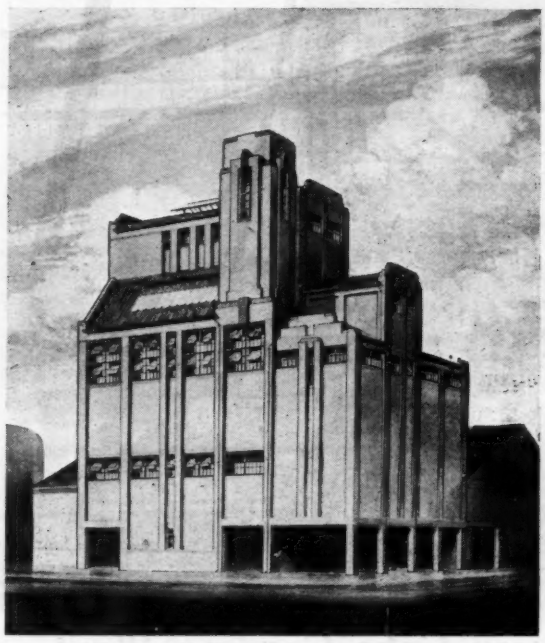

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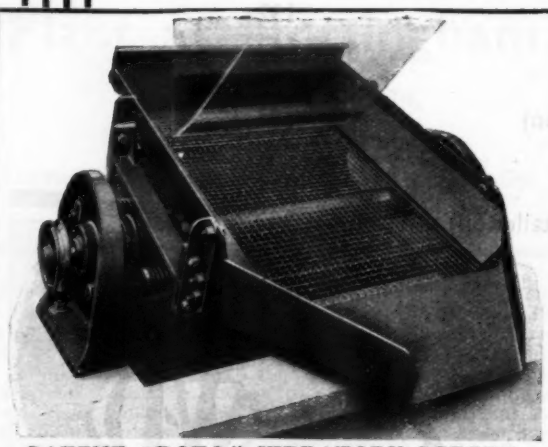

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** For Essential No. 2, see page 703.*

lengthy experience at Liverpool of the caustic soda washing process and of sand (or shot) blasting the conclusion has been reached that these processes are objectionable and in most cases unnecessary.

Incineration followed by cleaning with wire brushes, either machine or hand operated, is preferable. At Nottingham incineration by surface combustion has been adopted, but shot blasting is still used for cleaning the castings. With regard to incineration, a much smaller gas-fired furnace is used at Liverpool, holding four cookers only at a time compared with 22 at Nottingham, but capable of giving a greater output per 24 hours, the cookers remaining in the furnace for only 20 minutes compared with 2¾ hours in the case of Nottingham, and the gas consumption per cooker being 186 cu.ft., compared with 253 cu.ft. at Nottingham. It would be interesting to compare the results more closely as the smaller furnace will show a saving of capital cost and space as well as in gas consumption if it will do the work equally well.

Mr. J. T. Haynes (Rotherham): Having had the pleasure some years ago of serving under Mr. Dixon, I am not at all surprised to hear of the admirable results achieved at Nottingham by the whole-hearted co-operation which Mr. Dixon inspires among his staff. It must have been a privilege to share in the work so ably described in the Paper. It is a record of which Mr. Dixon may well be proud.

In his Paper Mr. Dixon throws out a challenge to those responsible for coke ovens. The difficulties arising out of the difference between the summer and winter requirements of a gas undertaking ought to be well understood by both parties, and it is difficult to believe that coke ovens refuse to accept payment for a proportion of their surplus gas, simply because they cannot dispose of the whole quantity throughout the 12 months. Agreements recently made in the Rotherham area provide for the summer quantity to be two-thirds of the winter quantity. When surplus coke oven gas can be supplied at a price sufficiently low to enable an industrial load to be developed this proportion is within the range of the gas undertaking.

Modern coke oven supplies are as reliable as those from any gas undertaking's own retort house, and when several undertakings draw gas from one coke oven plant or from the same group of coke ovens, so that the mains of various undertakings are actually coupled together as occurs in South Yorkshire, a local gas grid is a practical possibility. There is little doubt such gas grids would be economic, both from the national and local viewpoint, and it is suggested that their development should be more positively fostered and encouraged by the national gas organizations. The formation of local gas boards, such as that suggested by Mr. Dixon, seems to be a natural development of the work already accomplished in the South Yorkshire area.

Expense Justified.

Mr. Dixon's description of the work done in the reconstruction and reorganization of the distribution shops is particularly interesting to one who during the last few years has been engaged in reorganizing his own distribution department. Some 12 months ago the cooker shops at Rotherham were re-arranged by the installation of incinerating and spraying plant. The resulting improvement in the conditions under which the employees work is in itself sufficient to justify the expense. But apart from that, the output of the shop has been increased with a resulting reduction in the cost of cooker repairs. The staff was too small to enable any labour to be displaced and—as the plant provided for future needs is in operation to only about 30 per cent. of its capacity—we are unable to achieve the startlingly low costs quoted by Mr. Dixon, but our results also justify the expense on an £ s. d. basis.

With regard to the central heating plant, it is asked if any attempt is made to determine the relative merits of the various boilers. A potential consumer who may be invited to inspect the installation at Nottingham would naturally want to know the merits and disadvantages of each type, and the salesman must be in a position to support his recommendation.

Mr. Dixon's Paper is an inspiration to the younger generation, and should serve as a guide to all who are called upon to carry out reconstruction and organization.

Mr. F. G. Shaw (Buxton): First of all, I wish to say how completely this Paper has been packed with interesting matter for everyone, and I should expect that the number of members who desire to speak on this Paper must be a record.

With reference to the Eastcroft Vertical Installation, I am at present installing a plant of the Glover-West continuous verticals of approximately, when completed, one-third the size of Mr. Dixon's plant.

I might say that I was a joint inventor and patentee in connection with continuous vertical retorts as early as 1909, and my decision now, after so many years, to adopt this system of carbonization is confirmed by Mr. Dixon in the results he has attained by the careful attention to insulation of the settings and in other directions to improve what has been undoubtedly a serious drawback to continuous verticals—*i.e.*, low coke for sale results. I am convinced that, in my local circumstances, I shall obtain the best revenue figures per ton for continuous vertical coke.

The great point I have to wait and see about is how much coke I can sell per ton of coal carbonized. The figures given in Table 8 are, in my opinion, remarkably good, and, knowing Mr. Dixon as we do in the Manchester District particularly, I am certain that he can confirm his figures from actual sales of coke per ton of coal carbonized. I should greatly appreciate his communicating his sales of coke per ton figures. The costs given in Table 7 are most useful, and I should imagine that, speaking generally, these would not be so advantageous to-day.

Coke Quality.

For a considerable period I have been interested in the consideration of coke quality. All systems of carbonizing appear to claim coke quality as a special feature. "Good hard coke" seems to be a favourite term.

As we are subjected to competition from furnace coke, it has always been my contention that, instead of attempting to meet like with like, gas undertakings should consider another method of meeting competition where the financial odds are not all on the other side. My idea is to produce a lighter and more readily ignitable and free burning coke, and obtain a higher price for it in a field where there is less likelihood of keen competition. This quality may be either inherent in the coke or added by treatment.

I am inclined to think that with regard to the obtaining this quality of coke, naturally, the complete analysis of the coal to be carbonized is required.

Before I leave this section of the Paper, I venture to predict that, following these lines of thought, further improvement in the fuel economy of continuous vertical retorts is highly probable if engineers will insist in giving this point particular importance. May I ask a question? Can Mr. Dixon give his sulphur compounds figure for the gas produced in the installation?

Now with regard to the second section of the Paper dealing with the renovation of cookers. I should like to preach a little sermon. The words of my text are to be found under "Process and Plant," first paragraph: . . . "Cookers received from the District are first inspected to see if they are to be renovated or scrapped." . . .

I will now ask you to turn to Figure 18, where there is to be seen an illustration of a workman removing a cooker to the scrap heap. At any rate, that is where it would be going at Buxton.

My decided conviction is that the introduction of the bottom flue outlet and single burner oven cooker about 1925 rendered all others obsolete according to the present development of electrical competition. You will notice that I refer to the cooker oven only, as this is where most particular provision should be made to meet competition.

We owe it our duty to put out gas cooking apparatus of the highest practical efficiency in the cooker *oven*, where our position is not so strong as on the hotplate.

If the result of Mr. Dixon's efficiency in designing and laying down plant to renovate cookers so cheaply is going to result in his retaining the old two-burner top flue outlet oven in his District longer than otherwise, it will do him and his Department a great disservice.

On service and maintenance alone, I can say that, after experience of two-thirds of the cookers in Buxton being of the single-burner, bottom flue outlet oven type, approximately 2,000 out of 3,000, altogether the maintenance, cleaning, &c., of the old ones, amounting to 1,000, accounts for 90 per cent. of my cooker service and maintenance cost. Nor will it do to adopt an all-enamelled cooker with a thermal efficiency in use dating back to 1885, many of which are unfortunately on the market. The enamel does not do the cooking.

I congratulate Mr. Dixon on his Paper, which I assure him is of great value to me, but, as I consider myself an average member of this Institution, I feel confident in stating—of great value to us all.

Scope for Energy.

Mr. J. Mitchell (Leicester): It gives me very great pleasure to have this opportunity of taking part in the discussion upon Mr. Dixon's Paper, and at the commencement I would like to congratulate him upon his excellent Address, and on the manner in which he has tackled the problems which confronted him at Nottingham.

Mr. Dixon has found no doubt, as he indicates in his Paper, plenty of scope for his energies, but there must be few of us who, confronted with the same problems, are

fortunate enough to have such a handsome sum of over £900,000 available in funds.

The Author was good enough to give me the opportunity of seeing the new plant, while under construction at the Eastcroft Works, and also the new Distribution Department. I must say that I was greatly impressed by both.

With regard to the Eastcroft Works there were certain points which one could not fail to admire, the first and foremost being the design of the building, which in appearance strikes an entirely new line, and is not without architectural beauty.

Secondly, the segregation of the waste-heat boilers and the electrical plant in separate buildings is admirable. Another pleasing feature is the accessibility to all running parts of the plant, and especially the conveyor plant. As I remarked previously, I have not had an opportunity of seeing the plant running, and I would be pleased if Mr. Dixon could augment his remarks by telling us his experience with the "Undulo" coke screen. I can quite believe that this method of dealing with the coke prevents any undue breakage, but it would be interesting to know how the perforated rubber sheets have stood up to the work, and whether there is any tendency for the holes to become enlarged or misshapen.

With reference to the reorganization of the distribution shops, Mr. Dixon knows that I am very interested in the question of stove renovation, and with regard to this there is just one point that I would like to make, which I think would be of interest to the Industry.

Recently, a sanitary inspector called upon me with a complaint that in a very respectable residential quarter of Leicester people have been troubled by "visitors." The inspector asked our method of dealing with the cleaning of cooking stoves, and I was able to assure him that the trouble which he was complaining of could not possibly have come from the cooking stoves, because our cookers, when they were returned, were dismantled and all the old slag wool thrown away while the parts were all independently cleaned in caustic baths.

We are told that these "visitors" could withstand very high temperatures, as a matter of fact they relish warm quarters, such as the slag wool in cooking stoves, and I would like to ask Mr. Dixon if he can give any information upon this subject. If experience proves that incineration destroys both the living and the unborn, it is quite evident that to eliminate the necessity for dismantling stoves will greatly reduce the cost of their renovation. In conclusion, may I again offer Mr. Dixon congratulations upon his most instructive Paper.

When Collieries Sell Coal Gas.

Mr. T. R. Cook (Blackpool): Permit me to join in the congratulatory remarks already passed to Mr. Dixon for the very interesting and informative communication he has placed before the members of the Institution.

I was rather amused at Mr. Dixon standing as a champion of coke oven gas. I wonder what will occur when the colliery owners really get together in selling coal gas!

Some years ago I had the good fortune to work under Mr. Dixon as a Junior and I have always had the highest regard for him and appreciated his guidance and assistance during my early training. I know that any problem he attacks is approached from first principles and he is a stickler for detail work. His Paper is what I anticipated he would give, a real practical effort giving details as to how money has been saved at Nottingham in the recent reconstruction work, entirely due to his engineering and management ability.

There are several points in the Paper I want to touch upon. Manufacturing costs into holder are influenced to a great extent by the low cost of coal and good results obtained from sales of residuals (10d. per 1,000 cu.ft.). Are the repairs to plant normal figures or on the low side due to the introduction of new plant?

Dealing with the "Dri-Gas" plant, the Chart shows rust and water total 5,000 complaints. For the year 1932 complaints 12,500, over 10 per cent. complaints; 1933, 10,800; 1934, 5,000, less than 5 per cent. I should like to congratulate Mr. Dixon on the big effort he has made to improve the service to the consumer and the success he has achieved. I am sure that Mr. Dixon will not be satisfied until he has further reduced his complaints attributable to rust and water. These are alarming figures. I say that because in the undertaking I serve the total complaints due to water and corrosion during the past year have been 168 out of 38,000 consumers and this is very largely attributable to the "Dri-Gas" plant, which it would be impossible for us to be without. Coke oven supplies.—Section C.—Reduction in tar production results as coal is displaced and it is necessary to import tar products for road works and other purposes. I should like some explanation on this point as I have understood for some time that there is a great deal more tar made in this country than can be sold due to the competition of bitumen. Coke Analyses.—Moisture 6·2 per cent. Ash 6·99 per cent. This is an excellent result having regard to the amount of ash in the coals used which average in the region of 5 per cent. I am envious of the low price of coal at 17s. 2·69d. What is the pit price of Nottingham and Derbyshire coals he is purchasing? In the analysis of coals are the volatile matters given inclusive of moisture content? I ask this question particularly because the test results of volatile matter is given as 34·1 per cent. and moisture as 7·5 per cent. How much inherent moisture is there in the coal? I have recently carried out similar arrangements with regard to water supplies, using well water entirely for condensers and boilers, utilizing cooling towers to deal with the return water from the condensers. The well water is 42·4 per cent. total hardness, chlorine 54·4 per cent., magnesium sulphate 17·2 per cent. We are dealing with this water through the "Neckar" water softening system and "Air Flock" system and the combined cost is working out at 4d. per 1,000 gallons. The question of the water supplies will hinge to a large extent on the cost of town water and I should like to ask Mr. Dixon the cost of town water at Nottingham. In our own case the cost is 1s. 10d. per 1,000 gallons, which would be very costly to use for waste-heat and Lancashire boilers.

Mr. Dixon gives the value of tar between 59s. and 61s. If we take the lower figure less 12s. per ton working costs he is receiving 47s. a ton for his tar. This seems to be a remarkably good price, but as no capital charges are given the net value cannot be ascertained. Would Mr. Dixon give us the figures (as a matter of interest)?

Regarding distribution, I want to congratulate Mr. Dixon on the reorganization of the Distribution staff and reconstruction of the Distribution shops, particularly in the fact that he was able to transfer to a section of consumers' maintenance fitters 20 men displaced by this reconstruction and reorganization. The section dealing with machines and appliances in these shops is extremely interesting and will be of great value to me as we have at present new shops under erection on a smaller scale. Thank you, Mr. President, for the opportunity of speaking, and many thanks to you, Mr. Dixon, for the interesting information in your Paper.

Proximity to Coalfields.

Mr. E. Crowther (Salford): Nottingham appears to be very favourably situated, both in respect of the price at which its undertaking can purchase coal—and this seems to be a feature dependent on its proximity to the coalfields—and the prices it can obtain for coke and other residuals, which latter prices are perhaps the more remarkable for a concern situated so close to the coke-ovens and the coalfields from which it draws its supplies. To what extent this happy position is due to the geographical situation of Nottingham, between the coalfields and an agricultural district, and to what extent it is due to the care with which the coke is prepared and marketed, perhaps Mr. Dixon will tell us. But a more important point is, how secure is that position going to be in the future? For how much longer can Nottingham rely upon buying its coals at the price indicated? The Industry must remember that we are still face-to-face with the threat, not only of increased prices for coal, but of prices which will discriminate against ourselves and other public utilities. At the same time, what is going to be the position in regard to the residuals market if the district is flooded with a low-priced oven coke? It will not be difficult, as the result of quite a small adjustment of the prices of both the coal and the coke, to double the net cost of coal, as expressed in pence per therm.

Given security in those respects, of course, I think the choice of plant appears to be fully justified—although one might ask whether there has been any difficulty in retaining the coke customers who have purchased hitherto the horizontal retort coke in Nottingham and who now are faced with a choice between a vertical retort coke or oven coke. Has not Mr. Dixon found that the custom of some of these people, who require a fairly dense, robust coke, is difficult to retain now that the gas undertaking has only vertical retort coke to offer them? From that point of view I should be interested to learn Mr. Dixon's reasons for excluding from consideration the intermittent vertical retort, which would have yielded a denser coke, and yet, apparently, would have fitted in with the site requirements at his Eastcroft works. The reason set out for the decision to develop those works rather than to centralize at Basford admit of no argument, so long as the net coal figure remains unaltered. Were this figure altered materially, an attractive alternative might be an extension of the Basford Works by means of water gas plant. In this connection, following the reconstruction of the latter plant, at Basford, Mr. Dixon will have an admirable op-

portunity of putting to the test figures which have been given as estimates recently to the Industry as between the cost of running base-load plant and the cost of running plant which is taking the bulk of the peak load. I gather that the reconstruction at Basford will follow similar lines, although, of course, on a larger scale, to the work at Eastcroft, so that there will be an admirable opportunity of comparing the running costs of a plant running at 100 per cent. and a plant having to carry the seasonal fluctuations of demand.

Architecture and Gas Engineering.

I should like to congratulate Mr. Dixon on having brought architecture back into gas engineering. I think the money is very well spent, not only from the point of view of the convenience of the men and the general appearance of the Works, but as a matter of prestige among the surrounding works and to the Gas Industry generally. The work there has turned my thoughts into a new direction on this question of structural engineering from an architectural point of view.

There is no mention of benzole in the Paper; yet one would imagine that even with continuous vertical retorts there would have been a margin before a calorific value above the economic calorific value was reached which would have enabled Mr. Dixon to take out perhaps 1½ gallons of benzole; and although there is no fortune to be made out of that, none the less I should have believed that there would have been derived an advantage worthy of his consideration.

I should like to know whether air injection is required on the producers when working on breeze. Again, what are the arrangements for making good a deficiency of steam to the retorts when the generators are on light load? At what temperature and efficiency does the cyclone tar extractor work, and is the tar collected from it deposited in the well with the general tar or treated separately? Finally, is there any inconvenience in practice in the intermittent movement of the relief shift to and from the yard gang?

Mr. JOHN WILKINSON (formerly of Nottingham): I am afraid the President's instruction to speakers that they should not absorb time in praising the Authors of the Papers presented has rather cut the ground from under my feet, inasmuch as I came here to express my congratulations to Mr. Dixon upon the manner in which he has carried out the reconstruction work. I notice that, in his introduction, Mr. Dixon referred to the financial position of the undertaking having been nursed carefully for a number of years. Having acted as a nurse for many years in this respect, I desire to take the opportunity of expressing my appreciation of the manner in which Mr. Dixon has dealt with the lusty youth on attaining the age of 21. I have had the opportunity of inspecting the reconstruction work, and, knowing the works as I have done for 21 years prior to Mr. Dixon taking control at Nottingham, I am indeed surprised, and agreeably surprised, by the manner in which he has carried out the work, and by the way in which he has considered not only the artistic aspects of the buildings, but also the welfare of the workmen. It has fallen to my lot when at Nottingham to destroy three or four of the retort houses and chimneys, which were erected by that celebrated engineer of ages past, Sir Thomas Hawksley; and although, no doubt, their cost, on the basis of present-day standards, would be prohibitive, they were certainly fit to look at—even the chimney stacks—and, no matter what Mr. Gibson may think about the "cathedral-like" appearance of the retort house at Eastcroft, it is in my opinion fit to look at and well worth the extra money.

Ground Space and Gas Production.

So far as the construction of the carbonizing plant and accessories is concerned, I must confess that, without doubt, these are the finest I have ever seen. When I realize that, some 24 years ago, a fairly large retort house and 48 vertical retorts were required to produce a million and a quarter cu.ft. of gas per day, and when I find that at Eastcroft to-day that quantity of gas can be turned out by plant comprising only 18 retorts and occupying only a quarter of the space occupied by our old carbonizing plant, I am indeed surprised. It fell to my lot to be one of the pioneers of vertical retorts. My first experience of them was that I burned out three settings. Some years afterwards I turned over to another design, and I burned out three of those. But apparently the advance has been so material and so substantial and so lasting that nowadays we can put down a plant which, including all the generating plant, the waste-heat boiler plant, and so on, occupies only 25 per cent. of the space that was occupied by the original horizontal and inclined plant. Further, the working conditions for the staff are very much superior to-day. I do appreciate most sincerely the manner in which Mr. Dixon has carried out the reconstruction of these works.

Mr. J. H. CLEGG (Southport): As expected, Mr. Dixon's Paper shows a certain amount of originality. He has given us various reasons for the reconstruction of the works at Nottingham; but, after wandering through the figures given, I am just a little at a loss to understand them thoroughly in some directions. As has been mentioned, we are all particularly impressed by the price at which Mr. Dixon can buy his coal. For instance, the average price at Radford works is 16s. 8d. per ton; that would be regarded as a pit price for Lancashire coal. To some extent it has been considered that if an engineer makes cheap gas, and if his coal is cheap, this is merely a fortuitous circumstance, so that no particular credit has been given to him; but, surely, although he may have the good fortune to be able to purchase coal cheaply, it is to some extent a tribute to his commercial acumen! In comparing the costs of coal at Mr. Dixon's works, I notice that at the Eastcroft Works there are horizontal and inclined retorts; and yet the cost of coal in 1932 was 18s. 6d. per ton, as compared with 16s. 8d. per ton at the Radford Works, where verticals were in use, and 17s. 2d. per ton at Basford Works, where verticals were used. My experience has always been that one can buy coal suitable for horizontals at between 3s. and 4s. per ton cheaper than coal for vertical retorts. Of course, the cost of carbonizing wages (2·37d. per 1,000 cu.ft.) at Eastcroft is high, probably because the plant was old. Modern horizontals can be worked at a labour cost slightly over 1d. per 1,000 cu.ft. I am also particularly impressed by the maintenance costs. The figure of 1·94d., at Radford, was particularly low; the 2·12d., relating to Basford, was nearer the average figure; probably the high figure of 4·51d., at Eastcroft, was due again to the age of the plant. But, after taking these particular features into consideration, I have not yet decided which works would be producing the best results, assuming plants of equal age. By dividing the cost per ton by the production cost per 1,000 cu.ft., it would appear that the yield per ton of coal is very similar for the three works.

Effect of Gas-Drying Plant.

I notice that Mr. Dixon installed a "Dri-Gas" and naphthalene plant, and I am wondering why he had naphthalene. Was the naphthalene produced by the original horizontal retorts? I have usually found that where water-gas is used, there is very little tendency towards trouble with naphthalene, even with horizontals. I have not much experience of "Dri-Gas" plant, but I should be glad if Mr. Dixon would say whether he has found any detrimental effect in the working of his meters since the installation of his "Dri-Gas" plant.

The question of coke-oven gas supplies is certainly one which can be argued from many points of view. There is no doubt that modern coke-oven practice will supply us with the gas, introducing no greater degree of danger of lack of supply than with respect to gas produced at a gas works. In any case, it is necessary to make such provisions in the agreements as will provide for alternative labour or alternative methods of production of gas, both by having standby plant on the gas works and by having outside supplies of coal and coke which would be available in the event of a coal strike. There is no doubt that there can be considerable advantages in purchasing coke-oven gas, if it is purchased at a reasonable price. But there is also a danger, in that some of the coke-oven people are putting down plant in order to supply gas to gas works, as they find it so profitable at some of the prices they can obtain—and there is an increasing amount of coke produced by these coke-ovens, with which we have to compete.

I was particularly interested in the thought which Mr. Dixon has given in the preparation of his steam system and his water supply. He has used town's water for boilers and condensers, and I should be glad if he would state whether he has experienced corrosion of tubes due to excess oxygen and CO_2, or whether he has sufficient experience to be able to say whether it is necessary to consider the de-gassing of town's water. I am surprised by the steam consumption per KW.-hour generated. Even in the estimates, provision was made for 47·5 to 61 lb., depending on the load per KW.-hour, which was rather high, and in the Paper the figure is 120 lb. per KW.-hour. I think he was wise in deciding on a back-pressure engine and using the exhaust steam on his verticals, although I am rather astonished by the small amount of steam required as surplus over and above that required for electrical generation.

I do not think we have given sufficient thought to the use of high-pressure steam. Time after time I find that boilers of 100 lb. pressure have been installed; even with the

comparatively low pressure of 200 lb. great advantages are to be obtained.

Steam Production.

Mr. Dixon, in common with other engineers, has provided in his installation for the addition of producer gas for admission to the waste-heat boiler in the event of not having sufficient waste heat to produce the steam required; yet he is working his Lancashire boiler. Is that from the point of view of safety or as a standby in case one or both of the waste-heat boilers are shut down? I imagine that for the greater part of the year Mr. Dixon could safely produce the steam required entirely by the use of his waste-heat boilers, and particularly with the addition of his producer gas. If Mr. Dixon has used that method, I should like to know whether it was perfectly successful. I should like to hear further about the screens when Mr. Dixon has a longer experience than 19 weeks in respect of maintenance; not that I feel pessimistic or critical about them, but I think they are worthy of consideration, and we might have more information on this particular point.

The portion of the Paper dealing with distribution is particularly interesting, and contains information valuable to all of us. But I am at a loss to understand why Mr. Dixon and Mr. Mitchell require to clean 300 cookers per week. I appreciate the interest Mr. Dixon has taken in introducing architectural features in the gas works. When you look at some of the buildings existing in gas works you will have no doubt that a modern, properly designed building will cost no more than they have cost; the sooner we can depart from the old type, with massive brickwork, some of which are eyesores, the better. But there is the danger that a retort house structure may be made too complicated and expensive, in view of the possibility that modern progress may demand new carbonization plant, and if the building is not capable of the necessary reconstruction in such an event, the undertaking concerned may find itself with an expensive building on its hands.

The Gas Account

By W. B. McLUSKY,

Engineer and Manager of the Halifax Corporation Gas Department

Mr. C. F. Botley (Hastings): This Paper will be very welcome at this time, when everybody is giving attention to this most important matter of prices, and it has been my privilege to compare notes with the Author many times; he was a member of the Gas Charges Committee. First of all, I come to an important point that the prices in any tariff must have in the first instance some relation to the cost at which the commodity is produced. It is a remarkable coincidence that the figures in Figure 1, items 15 and 16, Form C, are identical with those of my own Company; the coal cost, less residuals, in pence per therm, last year was 1·96, and the cost, less residuals, for the year previous to the war was 1·59.

I have been in the habit of looking at all the various tariffs which have been put forward, and it is very gratifying to find that so many members of the Institution are giving a lead in these matters and have done excellent work in popularizing tariffs. Tariffs which apparently suit one place most certainly do not suit another. I thought I would consider what would happen at Hastings if I followed the example of Halifax. I find that if we took the same figures as were taken at Halifax, last year we should have had a deficit of £28,381. That illustrates that a tariff which is perfectly satisfactory in one place is impracticable in another.

Mr. McLusky gives some figures representing service-rental charges per week. If you convert his figures into annual figures you will find they come to 26s., £8 9s., and £208 per annum. It is interesting to note that the 10·8d. per week service-rental charge used by the Author represents £2 6s. 9d. per annum; and also that the Hastings figure indicating the increased price received from gas in 1934 over the pre-war or the war-time price is 32 per cent., against the Author's figure of 50 per cent., mentioned at the end of Part III of the Paper.

With regard to the component parts of a tariff, it has been my lot to look into a great many tariffs, and I have always found that one of the difficulties in arranging a tariff is the service portion of that tariff. Sometimes we are met with the rateable value basis. That is not a very acceptable basis; if anyone wants to appreciate how unsatisfactory it is, I would commend attention to Table 2, in Part V of the Paper. At Hastings we have had some difficulty, and at the present time we are using as an alternative to the flat rate a tariff which might be called multi-part, because it has three components. It has a quantity, a service price, and a commodity price. It has been satisfactory in meeting the legitimate demands for special prices, but, as in Halifax, we find that only a proportion of our consumers will be attracted by the tariff, because, after all, it is only the consumer who will use a fair quantity of gas for industrial or domestic purposes who will be attracted by a tariff. We at Hastings have dissected our figures over a period of a good many years, and, although I have not with me the latest figures, I have some which may be useful. Taking the two-part tariff, the service charge is only from 37 to 35 per cent., and the commodity charge from 63 to 65 per cent. So that it is a very good guide, one-third to two-thirds. Mr. McLusky makes the very good point that if we could possibly get our consumers to accept a higher charge for the service, we could then put forward an attractive commodity price. Something might be done on those lines.

Extraordinary Financial Ventures.

In the electrical industry, where they are using tariffs, and particularly the two-part tariff, they have load business, and they have most extraordinary financial ventures. I have the most recently published figures relating to the Hastings electricity undertaking, which is supplying an area outside Hastings, as well as the Borough; only half the output is taken in the Borough of Hastings. No less than 79¼ per cent. of their output was sold at a figure less than the normal cost of selling—*i.e.*, the self-supporting cost, which was about 1½d. They obtained for 13 per cent. of their output no less than 42 per cent. of their revenue. When they can do these things, it behoves us to see whether we cannot take our courage into our hands and make advances in that field of development.

Mr. J. T. Haynes (Rotherham): I find myself so closely in agreement with Mr. McLusky on principles relating to tariffs and the gas unit that it is difficult to offer any criticism on his Paper, but a discussion should be critical if we are to avoid becoming a Mutual Admiration Society. Mr. McLusky has presented in his own incomparable way a number of facts, as he sees them, and we offer to him our congratulations on the initiative and the success which has marked his progress in the Industry. On many sides we hear of a demand for a lead to be given by the leaders of the Industry on methods of charging for gas. I could wish that Mr. McLusky, while giving us such a large amount of information regarding multiple tariffs, block systems, &c., had been more conclusive. His Paper does not help the timorous engineer to decide on any one system. Mr. McLusky himself is ready to try various combinations to suit particular sets of circumstances. For each and every consumer one or other method of charge is successful, but which is the one so far in advance of the remainder that other engineers are induced to try it out for themselves?

In the cases selected by Mr. McLusky as typical of the Industry, the sales of gas per consumer seem to vary quite independently of the method of charge in operation; perhaps the change from the flat rate is still too recent to be effective; but it is interesting to note that case "C," which has a multiple tariff, has the lowest consumption per consumer. Again, one must look further than capital costs for movements in the price of gas. Are we satisfied with what has been done during the last twenty years, as indicated by the cost of coal less residuals? Mr. McLusky points out that undertaking "A" has the same figure today as before the war. In the case of undertaking "H" the cost of coal is doubled, while in the case of undertaking "D" the cost is trebled. In spite of my enthusiasm for tariffs, I suggest that methods of charge are not yet the "Be-all and End-all" of the Industry's problems.

Mr. McLusky accounts for the apparent neglect to adopt tariffs in the Gas Industry during the time that they have been developed by the electrical industry by saying that the price of gas was formerly so low that there was no

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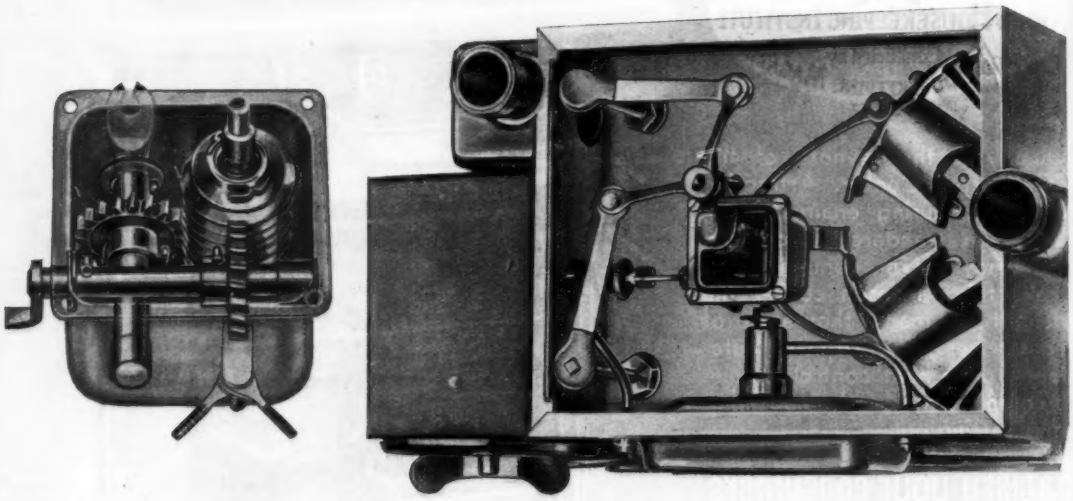

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urgent need for multiple tariffs. This seems to be more of an excuse than a reason! The appeal of the "Unit" is a strong one, but our experience in Rotherham indicates that what may appear simple and straightforward to the engineer and the salesman is received very cautiously by the consumer. He cannot believe that the gas undertaking wants to give something for nothing! There must be a catch in it somewhere!

The sting of Mr. McLusky's Paper is in its tail. Mr. McLusky proposes that the price of gas should be determined by a National Gas Board composed of consumers' representatives and representatives of the Gas Industry, both management and employees. Can we picture such a Board? Surely local Gas Boards are already in existence —every Municipal Gas Committee is, in effect, a Board representative of the management, the employees as represented by Labour Councillors, and representatives elected by gas consumers. Such Boards stand still or progress only in proportion to the initiative and driving force of one or the other of the representatives. The progressive spirit of the Halifax Board is personified in Mr. McLusky, but can we be assured of the McLusky spirit on the proposed National Gas Board? A progressive spirit must be more in evidence locally before it can be effective nationally.

A Subject of Vital Importance.

Mr. CHARLES R. INGHAM (Brighouse): This subject of gas charges is of vital importance. At the present time we are fighting an unfair battle; it is as though an army went into battle armed with bows and arrows against an opponent equipped with full modern armament. We are not pulling our full weight, simply because we are not making our charges in the best way. I appreciate that it is very easy to say that and that it is very hard to indicate exactly how we should alter our methods. Mr. McLusky has been working on this subject for many years, whereas I have been closely interested only for a very few years, and I feel very diffident in saying what I propose to do.

Generally speaking, it costs us about 4d. per therm to supply additional demands for gas, and we are charging, in round figures, about 8d. per therm—a sheer 100 per cent. profit on additional business. What we are out for to-day is additional business per consumer; if we do not succeed in getting it, we shall fail completely. I do not think we can justify for a moment this 100 per cent. profit on additional business. In Part IV of the Paper, the Author makes what I consider to be a very important statement, that "It is not enough to have a low average price received, unless the average user is enjoying, to some extent, the advantages of that low figure." Any undertaking can introduce a two-part tariff, and it may be that that is the best thing to do. But a big number of your domestic consumers will not be supplied on that tariff unless, as time goes on, you are able to make it more attractive. Certainly I do not think that many undertakings to-day could introduce an attractive two-part tariff and get the majority of its consumers on to it. A company, of course, cannot go very far in the direction of the block rate, because the price of its first block determines the dividend. Therefore, the two-part tariff is the best line of attack for a company. A municipal authority, however, is not tied up quite to the same extent; it can charge what it likes, provided that charge does not exceed the maximum fixed by Parliament. My own undertaking increased the price from 7d. to 10·8d. per therm for the first five therms used per quarter; and I think that many undertakings ought to consider very seriously an increased price for the first small quantity. The effect, of course, is to arouse some opposition. The statement is made that the poor man is being penalized; but there is very little indeed in that. We charge 10·8d. for the first five therms per quarter, 7·2d. for the next ten therms per quarter, and for all in excess of fifteen therms we charge 4·05d. The result is that we can get down to bed-rock competition; we can charge a price which is almost competitive with coal, and there is every hope that in future we shall be able to get down to a price at which gas, for continuous use, is as cheap as coal.

It may be thought that the figure of 10·8d. per therm will be thrown up against us as representing the cost of gas; but we do not find that that is so. We find that our prices equal 1s. 8¼d. per 1,000 cu.ft.—and the ordinary man-in-the-street still thinks in thousands, and it is a basis which the consumer understands. I feel sure that by working on lines somewhat similar to those the Industry will secure business which to-day it is not getting.

Multifarious Schemes.

Mr. H. CURTIS (Macclesfield): In associating myself in the discussion on Mr. McLusky's Paper, I wish to congratulate him on the numerous statistics he gives to illustrate the multifarious schemes that have been tried in the very important subject of gas charges, and more particularly on the title he has given his Paper, a title which I think is of paramount importance to the Gas Industry to-day. I shall, no doubt, run up against a few of our members when I say that as far as our sales and success as an Industry are concerned the gas account is the most important factor. The consumer is more concerned with how much he will ultimately have to pay for the service he gets, rather than by what method is devised in order to ascertain the amount he will ultimately have to pay.

From what has already been said various speakers submit that a two-part tariff (domestic) is the solution of our difficulties; but is not the proof of the pudding in the eating? In the past we have had presented to us the experiences of where the two-part tariff has been in operation, and they have admitted that the inauguration of these schemes have not met with the desired results and they have also acknowledged the shortcomings of these schemes. It is very interesting to note the numerous schemes that have been evolved and put into operation during the last few months, and to my mind the weakness in many, if not all, is that the consumption of gas has to reach too high a figure before any benefit accrues to the consumer in a reduction in price of the flat rate. Much has been said in the past about the unremunerative consumer, but I am afraid that with any great success in the adoption of a two-part tariff we may find that the numerous small consumers are subsidizing those on the tariff scheme.

One point that was raised at our meeting last year by Mr. Bloor, of York, has caused me to consider it from a different aspect than I did twelve months ago. He asked: "Just precisely what load which we have not now got do we hope to secure by the adoption of two-part tariffs?" To my mind, the main load one would expect to obtain (domestic) is the heating load, and if this is the case one must anticipate the resultant facts that would obtain if these expectations materialized. If, and when, these results did happen there are many undertakings who would realize the "boomerang effect" of such circumstances. It has been my contention that the adoption of a two-part tariff would tend to make the summer and winter loads more divergent, in which case, unless there was surplus plant, it would necessitate further capital expenditure to accommodate this excessive peak load, and for which there would be no corresponding alllowance made in the commodity charge.

In Table 2 Mr. McLusky gives figures showing the increased business resulting from the operation of multiple tariffs in Halifax, and is to be congratulated upon the success achieved in these cases. To illustrate my previous contention, it would be interesting to learn the amount of increase in the summer and winter periods, and also what proportion these 88 cases bear to the total number of domestic consumers. If this information could be given I am sure it would be of great value. I would suggest that Table 2 is not quite complete; it would have been better had there been two more columns giving the amount of cash received for the amount of gas used before and after the introduction of his multiple tariff.

In Table 3 details are given showing that the average consumption per consumer on his Tariff Scale 2 is 41,377 cu.ft. This figure is below the quantity required to be used before any reduction in price is allowed. I would also suggest that in Scale 1 the reductions in price per therm are too small in comparison to the consumption required to qualify for a reduction.

Mr. McLusky states (and I agree) that there is a limit to the proportion of gas that can be supplied at the "Commodity rate" in a multiple tariff. What is going to happen when a tariff scheme is very successful? Is it to be supposed that the present-day smaller consumers are going to subsidize those on the tariff scheme, or will there have to be a revision of the terms? On further reference to Table 3, the figures given show that the percentage of gas consumed, non-tariff and tariff, is in the region of 72 and 28 respectively, whereas the cash received is 76 per cent. and 24 per cent. respectively. This is what one would expert, but what is going to happen when the percentages become more divergent?

No Analogy.

Much has been said regarding electricity; my opinion is that, definitely, there is no analogy, inasmuch that the price difference between the maximum and minimum is much greater than in the case of gas, and we can never hope to have the same latitude in devising or manipulating tariffs. In the introduction of Mr. McLusky's Paper, the Author reviews generally the details of charges, including the net price received per therm in each case. In the eight undertakings reviewed it will be found that different methods of charging have been adopted, and, when summarized, it is found that the five undertakings who have not adopted tariff schemes—*i.e.*, two-part or multiple, hold

the first five places as regards the lowest price received per therm, and the first four places for consumption per consumer. In my opinion far too much consideration is being taken of the present-day comparatively large consumer and not enough notice taken of the smaller consumer who is without doubt the backbone of our Industry?

If more effort were made to decrease the maximum price charged I am sure that the consumption per consumer would increase, and on this depends the future of our success. In my own particular town the average consumption per prepayment meter has increased 66 per cent. in ten years, and although the average price charged per therm has been reduced, we have been able to make further profits, and have recently submitted to the Council proposals for a further reduction in the price charged. By increasing, say, only 10 per cent. in total consumption by increased consumption per consumer, the financial results would be far in excess of those obtained if 25 per cent. increased consumption was obtained with a low commodity charge.

Mr. GEORGE EVETTS (London): I should be glad if, in his written reply, Mr. McLusky would explain exactly what he means by the statement, in Appendix 3, that "The process necessary to obtain sanction to regulate the basis upon which the price of gas is fixed could be simplified." I think his proposed cure or solution is most inadequate to meet the situation. He says that this is a domestic question. Does he mean that it is a question to be solved in the homes of the people, because, if so, they will say "Give us the gas for nothing." If it is a question to be settled within the Industry, let the Industry settle it, and do not drag in such a hybrid tribunal as he suggests. I hope it will not go forward as representing the consensus of opinion of this Institution that his suggested way is the right way in which to settle this intricate problem.

Compromise between Policy and Economics.

We all recognize that any tariff must be a compromise between policy and economics. It is not easy, possibly, to introduce a scientifically correct tariff—and we must remember that these alternative tariffs are mostly voluntary. The Gas Industry, however, appears to be dipping into as many forms of tariff as the electrical industry, so that we shall soon find it necessary to appoint a committee, not to encourage tariffs, but to eliminate the many variations and to get back to comparative simplicity. The flat rate is dead, or, if not, it should be killed without delay. Although the Industry realizes this, it has given the governing bodies no lead. Halifax has six scales, and wisely starts the first unit of the block rate at 11d. per therm, compared with a net cost of gas, after adjusting for meters and stoves, of 8·67d. The scales, however, contain many anomalies, not only as between one another, but within themselves. In Part VII of the Paper, Mr. McLusky lays down the rule that "Gas, and nothing else, should be charged 'as per meter index,'" and that no consumer should be obliged to pay overhead charges "as per meter index." He departs from this principle in Scale 2 and Scale 3 by dropping the cost, after the first block, by as much as 9d. per 1,000 cu.ft.; and the first block in the industrial scale, No. 3, is six times as much as in the purely domestic scale, No. 2. Scale No. 3 is inconsistent, in so far as the greater the demand the greater is the charge per cu.ft. of demand. I have estimated a Halifax customer charged on a four-part basis at approximately 13s. 4d. per annum. Applying 3s. 4d. per quarter to Scale 3, it would appear that a demand as between 50 cu.ft. per hour and 300 cu.ft. per hour varies as 20:1—that is to say, the load is 6:1 and the demand charge for that load is 20:1. The consumer who objects to Scale 3 can jump back to Scale 2, burn the gas at any rate per hour he may choose, and save as much as 8d. or 9d. per 1,000 cu.ft. In scale 6, the last two blocks may come on the hour of peak load, and yet the gas is sold in these blocks at 3d per therm, whereas the cost of the gas into holder is 3·37d. I wish Mr. McLusky would think over this matter again and try to arrive at a simple scale of charges.

Mr. T. P. RIDLEY (Newcastle): Mr. McLusky shows a number of tariffs which indicate that he has found that certain special purposes require their own special tariffs, and I think that many of us before we have had as much experience of tariffs as Mr. McLusky will be following his lead. I presume from the figures given in Tables 3 and 4 that no coin consumers are on the two-part tariff. The price of 1s. 3d. shown in Scale 2 for the excess block is one which I think will compete with solid fuel for domestic purposes in Halifax for continuous space heating and water heating, both of which are classes of business we must strive to develop. The quantity of gas in the first block before getting down to 1s. 3d., however, is high.

The examples of domestic consumptions shown in Table 2 contain some remarkable figures, but they are scarcely representative of the whole because the examples show a much larger average consumption per consumer than the average of all consumers on that scale as shown in Table 3.

I agree with Mr. McLusky on the principle of grading tariffs for domestic consumers on a house basis, but I prefer grading on the number of rooms rather than one floor area of two rooms. I also prefer grading blocks of gas to grading service charges for domestic consumers. The disadvantage of a service charge is, as Mr. McLusky says, that the consumer has to commit himself to the payment of the service charge. In other words, you have to sell it to him and get a contract signed for it before you start to sell additional gas, whereas you put a block system into operation wholesale, and your salesman's energies and your publicity can be immediately concentrated on the selling of more gas as a result of the more attractive terms. In our experience the payment of a service charge by domestic consumers is not more conducive to pleasant relations than the block rate and with some consumers who with the service charge had to pay more in the summer quarters than on the general rate it had the reverse effect. Besides, the block rate is more easily applied to prepayment consumers, who represent a large proportion—in many cases the majority—of consumers.

The two-part tariff has been very successful with electrical undertakings, but their flat rates are very much higher than those of gas undertakings. Owing principally to the operation of the sliding scale the flat rate prices of gas undertakings are low. Therefore there is not the same scope for driving consumers on to a service charge system.

From Table 3 it is observed that only 10 per cent. of the total consumers have committed themselves to the multiple tariffs, notwithstanding that the initial price of the general rate is high. I would be glad if Mr. McLusky would say how many of his consumers are on Scale 7—*i.e.*, the all-in rate—for storage water heating. Are the consumptions metered and, if so, has he any information as to the average consumption per heater? This information would be of the utmost value to the Industry.

With regard to the statement that certain consumers may prefer a step scale or a block tariff to a two-part tariff with the full knowledge that they will have to pay more, especially towards the lower blocks of the scale than they would pay on a multiple tariff, I would like to point out that one consumer on a two-part tariff with a service charge of 10s. and commodity price of 4d. and another consumer on a block rate of 30 therms at 8d. and the excess at 4d., the charge is the same at and after 30 therms—and both will be on the same commodity price.

With regard to the question of charging by units instead of by therms, I am one who does not agree with charging by the "unit." To make the change will only cause confusion in the minds of the public, who do not understand what a therm is or what a unit is, but think they understand a "thousand cubic feet of gas." It is true that on a unit system the price per therm would be divided, but, on the other hand, the therm would be multiplied to bring it to units—*e.g.*, as to the latter, in a known case the gas tariff would not show a reduction until 25,000 units had been consumed, while the electrical competitor in the same district advertises in his tariff for the same purpose that the consumer will obtain a reduction after consuming 200 units. In another known case a gas consumer gets a reduction after consuming 30 therms. If this be converted to units his reduction would take place after consuming 750 units, whereas his electrical competitor is advertising a reduction after 32 units. In my opinion the disadvantages outweigh the advantages of a unit system of charge.

Colonel W. M. CARR (Stretford): Mr. McLusky, like many pioneers, has travelled a good many roads and has followed a good many tracks in studying this problem of charges. I should like, however, to call myself an early disciple of his in regard to the desirability of introducing a beneficial tariff for all classes of consumers, and to stress the point made by Mr. Evetts as to the desirability of extreme simplicity. It is essential that, before embarking upon any scheme of charges, we should endeavour to understand clearly the effect and the economics of the cost of supplying each individual class of consumer. I say, therefore, that a comparison such as is given by Mr. McLusky in his early tables is quite erroneous.

To begin with, in the case of the undertaking for which I am responsible, at Stretford, it would be impossible for me to make any comparison on the basis of cost per consumer unless I first pick out my large industrial consumer, whom I must regard from an entirely different angle from the domestic consumer; and any charge on any investigation of costs must be made, first of all, upon an actuarial value, on the cost of supplying the particular class of consumer for whom the charge is designed That is the principle which I think must apply to all tariff considerations. We have arrived at that conclusion, I think, as the

result of work done by Mr. McLusky, and I suggest that his Paper brings it out to a marked degree. Were I a consumer in Halifax, I should have very great difficulty in understanding how I should be affected by the tariff. Personally—and I stress that this is only my personal view—I do not agree with the grading of the demand charge on the basis of floor area or room area or assessable value. Our electrical friends would be very glad, I think, if they could get rid of the assessable value basis for the determination of their demand charge for electricity. In the case of the bulk of the domestic consumers, it is practicable to assess the demand charge on a fixed basis. Consumers in premises of more than a certain size can then be assessed on the basis of demand by the appliances installed. By that arrangement you do not prejudice the possibilities of future business, whereas you may prejudice the possibilities of future business or may prevent the consumer ever coming on to the two-part tariff if you assess him on a factor having nothing to do with the cost of supplying him with gas. In other words, the demand charge must be based on the standing cost to the undertaking.

I would again appeal to everybody to attack this subject originally from the point of view of the report of the Gas Charges Committee. You cannot arrive at any conclusion at all until you have first analyzed your accounts, and in the majority of cases you must sub-divide them, so far as the actual cost of supply is concerned, as between your domestic and your large industrial consumers. Mr. McLusky's Paper is provocative, and from that point of view it is very beneficial.

Mr. Botley has applied a certain scale to his own accounts and has told us that by so doing he would be faced with a deficit of £28,000. I suggest that that is an equally wrong way of looking at this problem. What he should assess first is the additional load he might get from the application of the tariff, and he should then make his deduction. To make a deduction on the assumption that the tariff will be of no benefit at all is definitely very wrong. So far as domestic consumers are concerned, I have experience of a very simple tariff over a period of only eight months, but it is sufficient to enable me to appreciate that the growth in business due to the application of a very simple tariff which can be understood clearly by the consumer will compensate, in my case at any rate, for what I estimate would be the loss if only those for whom it would be of immediate benefit took advantage of it.

POLICY AND PERFORMANCE IN

The Development of Gas Sales

By SAMUEL B. CHANDLER,

Distribution Superintendent of the Tottenham and District Gas Company

Sir FRANCIS GOODENOUGH, C.B.E.: Bowing to the President's instruction, I will not spend time in saying all that I could say in commendation of the Paper and its Author. I will only thank the Author for a very excellent, comprehensive, and stimulating Address.

He began by saying that some people might think this is not a subject for a meeting of The Institution of Gas Engineers. I am not going to discuss that suggestion; I will only say that I regard the sales side of our activities as a subject so urgent and important that I welcome every opportunity that is taken in the Industry to call attention to it. This is not the first time that the subject has been discussed on the platform of the Institution. Five years before the British Commercial Gas Association was formed —and (now at this date) we should have been very pleased to have had this Paper presented at one of its meetings—a Paper on "The Sale of Gas" was read at Dublin; a Paper that led up to the formation of the B.C.G.A. eventually. A year after it was formed, under the Presidency of a former Chairman of the Tottenham Company—Sir Corbet Woodall—another Paper was read (at the Centenary Meeting of the Institution), dealing with "The Creation of an Outdoor Staff." That Paper might also be regarded as providing a precedent for Mr. Chandler's Paper now before us.

I have not time to go over all the ground of that Paper, but in particular I want to emphasize the great importance of having the right personnel engaged on the commercial side of the Industry. Yesterday Colonel Carr, your President-Elect, referred to the great importance of having a properly trained and adequately paid staff on the commercial side as well as on the technical side, and I do not think you need me to say how strongly I agree with that view. You as engineers know that you cannot do a job properly without the right tools; and on the commercial side you must have the right quality tools if you are to get the best results. Further, you cannot get the right tools unless you pay the right price for them. So that you have to bear in mind both quality and price in regard to the commercial side of our personnel. The personnel on the commercial side has a cumulative effect, even a greater cumulative effect, than any showrooms and publicity can bring about. Unless your personnel can create the right feeling of friendliness between the public and the public utility undertaking, whether it be company or municipal, you cannot possibly achieve the measure of success that you want to achieve or the permanency of success which is so essential.

It is not surprising that the Tottenham Company should be able to present such a record as that presented in the Paper, seeing that the one-time Chairman of the Company and father of the Company's present Chairman was Sir Corbet Woodall, who had such a very keen perception of the importance of the commercial side of the Industry. We in the Gas Light and Coke Company—I say "we," although I am no longer in it, because I always feel part of it—for many years knew the force of his convictions in that direction, and I personally was very proud of being able to talk on the creation of an outdoor staff under his Presidency, because he had done so much to bring that about. It was due to his initiative that the apprenticeship scheme was established in the Gas Light and Coke Company, in 1909, I think; I can bear testimony to the enormous value of that apprenticeship scheme, which led to other developments.

I was very glad to see Mr. Chandler's reference to the Domestic Gas Salesmanship course of the B.C.G.A., and his commendation of it. I believe that the scheme, which was formed less than five years ago, has already done and is destined to do enormous good work for the Gas Industry. Unless you sharpen and re-sharpen your tools, even if you pay the right price for them and get the right quality, they will not continue to cut, and I would say to all my friends in administrative positions in the Industry, don't content yourselves with putting your staffs once through a course such as that, but continue to refresh them, because it is so easy to forget and go "blunt." I will not go over all the many points in Mr. Chandler's Paper on which I am in very complete agreement. I wanted to thank him for what he said on the question of staffs, and to stress the vital importance of the right recruitment of your staffs from the right products of good general education, and the careful and thorough training of them whilst they are in your employment. On your personnel depends your permanent profit.

Outlet Pressures.

Mr. ARTHUR ROBERTS (Hereford): In Part IV the Author makes reference to the outlet pressures at all terminal and governed points being maintained at 6 in. w.g. Does this pressure have any closing-up effect of the works governors during periods of low consumption? Can he say what the works governors are set at? Are the feeder mains of steel or cast iron? If the former, does the Author have any trouble with the deposition of dust in the gover-

nors or are dust traps used on the line of main? What pressure is the feeder main carrying?

In Part V mention is made of gasfitters on emergency service night duty being paid a retaining fee. Can Mr. Chandler tell us what this fee is, and, further, do these emergency men carry out any work during their shifts other than calls answered? In my own case we retain fitters at week-ends, but during the week a fitter (with cycle) is on duty from 6 a.m. until 11 p.m. for emergency calls, but his duties also consist of the repair and reconditioning of cookers, fires, and wash coppers. From 11 p.m. until 6 a.m. a messenger is sent to call a fitter if required. The mainlayer is always available by telephone. I think the Tottenham system is one which is of great value not only to the consumer but to the Undertaking, as it creates an atmosphere of ideal service. May I also congratulate the Tottenham Gas Company on their canvassing scheme. Similar personal contact in my small way has been of great value, and over 800 orders have been brought in in twelve months by service (uniformed) fitters calling house-to-house.

I am fully in agreement with Mr. Chandler on the question of taking an intelligent and practical interest in social activities; our competitors are very alive to the value of this link up. I personally make a point of giving talks to organizations on the advantages and merits of gas. With regard to Part XIV, I am interested in the daily all-in charges for storage heaters. My own figures are based on 14 hours per day full on and 10 hours on by-pass, and 21 days per annum have been allowed for absence from the house. With fixing cost, capital outlay and maintenance we offer an immersion heater at 7d. per day the first year, and 5d. per day for subsequent years, whereas the 20-gallon storage heater is offered at 8d. per day first year, and 6d. per day afterwards. We also have a hot water tariff of 6d. per therm net for circulators, gas-fired boilers, or high-consumption storage heaters, and this has enable us to secure the heating by means of a gas-fired boiler and hot water radiators of one of our largest cinemas.

Attention to Slot Consumers.

Mr. C. H. Chester (Swindon): The points in the Paper which have impressed me particularly are those relating to coin meter consumers and to the industrial load. I think that the part of the Paper dealing with the coin meter consumer should be stressed, because to the majority of undertakings the coin meter consumer still provides the bulk of the revenue; he pays the best price for his gas and, in my opinion, he should have a little more attention than he has had in the past. The Tottenham scheme is in very many respects, with the exception of price—I think the Tottenham Company gets a little more for it than we do—very similar to one inaugurated a couple of years ago in Swindon where, of a total 18,000 consumers, 14,000 were coin meter consumers. Among the 14,000 coin meter consumers, in two years we have disposed of 11,000 new appliances under a scheme similar to that outlined by Mr. Chandler, and the increase in the cost of gas to the consumer has hardly been felt, inasmuch as the two-part tariff scheme was devised with the object of allowing a little to go towards the cost of the provision of the appliances.

I think that in the design of any two-part tariff some little regard should be had to leaving a little to spare towards the apparatus with which to burn the gas. In my opinion it is of no use cutting the thing so finely as not to allow a little to be given in the way of service or in the fairing off of prices for the supply of appliances. That scheme has contributed largely to the rather rapid increase of our output during the last three years. The output to-day is 27 per cent. more than it was three years ago, without taking into consideration any additional districts.

In regard to the night load, I think we should take into consideration the effect upon the holder capacity. The purpose of holders, as engineers recognize it, is principally to store the gas made surplus to requirements generally during the night. In my opinion there is a very large night load to be picked up in this country, at special prices, and over special periods. This applies particularly to the baking industry; there is no other industry that occurs to me at the moment which is better than the baking industry as an example. I am indebted to Mr. Mitchell, of Leicester, for some very valuable assistance in regard to the provision of appliances for baking, as the result of which I have been enabled to develop a load which is now equivalent to 10 per cent. of my total output, and is taken during the night period, between 10 p.m. and 10 a.m. The rate is very special; different rates are charged for the day load and the night load, the rate during the day-time being double the night rate. The minimum price is 3½d. per therm, rising to 6½d. during the day time.

With regard to service arrangements with builders, the importance of maintaining continuous contact between the distribution department and the builders cannot be overemphasized, because if we are not in at the beginning of the building of houses we shall have great difficulty in getting the connections we want in the houses when they are newly built; a new house owner, generally a newly-wed, is too proud to have her house disturbed after it is built. There again, having left a little by, we can afford to give a little away on extra points, and in all houses to-day we fit three free fire points. The builder pays us £10 per house. We include other developments, and our standard fit-up for the past two years has been a cooker, water heater, geyser, and a gas copper.

An Opportune Time.

Mr. P. E. Brown (Brighton): This Paper comes at a very opportune time, and though Mr. Chandler said in his opening remarks that no doubt the larger undertakings had well-conceived schemes of their own, and his Paper was directed mainly to impress upon smaller undertakings the need for putting their houses in order, I think we shall all agree that we can all profit by taking the Paper home and reading it again and yet again. It is just what I expected of Mr. Chandler. I have had the privilege of his friendship for nearly 30 years; we were co-workers first of all in the same undertaking. I think he has stated that his Paper is provocative in some measure. It is direct and it is well-conceived, and that is typical of the man.

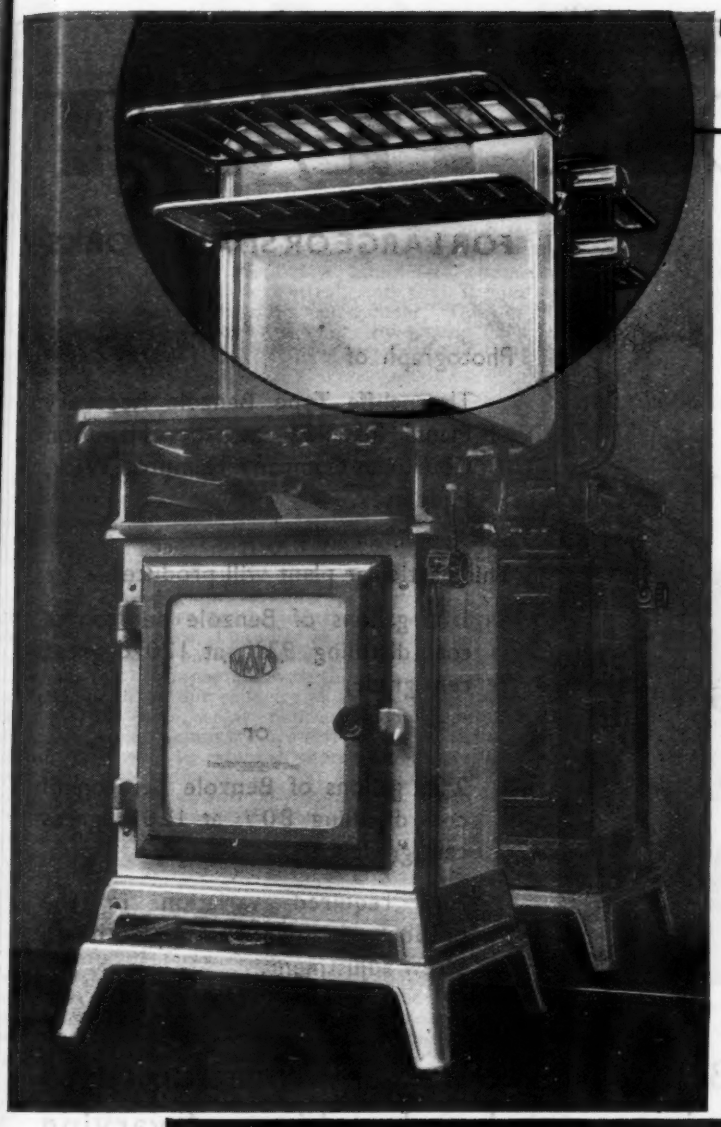
Since I shall not be allowed to say anything further in praise of him, perhaps I may be permitted to pay a tribute to his undertaking, the Tottenham Company, for having allowed him to set before the members such a well-ordered consideration of the organization of the undertaking.

On the canvassing side, Mr. Chandler stresses the importance of personal contact. I think none of us will have missed the point that our great rivals, the electrical industry, are very favoured in this regard, in that every electrical contractor is, willy-nilly, a canvasser for the electrical undertaking, because he has to live by the sale of his wiring and appliances. We have to visualize that when we talk of personal representation in our own areas of supply. Mr. Chandler speaks of his special effort in canvassing, whereby individual letters are sent in advance and the salesmen call upon the prospects subsequently. I should like to ask whether his commission scheme is applicable only to that type of salesman, or whether he pays commission also on orders which emanate from the office, through correspondence, and whether he pays his showroom assistants on a commission basis.

I think that a wise mixing of male and female staffs in showrooms is all to the good. In my own undertaking we have a women's advisory staff. We have found that the average woman visitor and potential customer for appliances prefers primarily to be served by a man, in the belief, I think, that he can tell her more technically what is the performance of the appliance she wishes to acquire. I have found that women did not necessarily prefer that women should serve them, especially the young and unmarried women; they are inclined to feel that the saleswoman has not had the experience that they themselves have had.

With regard to water heating, I agree with Mr. Chandler that perhaps the ideal system is the multi-point gas water heater *plus* the coke boiler. We should not lose sight of the fact that we must not spoil our solid fuel market by seeking to install gas-fired apparatus to the detriment of that market, because the solid fuel market has a great bearing on the price of gas.

I am intrigued by the Tottenham Company's procedure in regard to building development, and should like to ask Mr. Chandler if he has actually experienced difficulty, or, on the other hand, if he is satisfied that all the points that the builder puts in under the subsidy agreement terms are productive eventually of gas sales. There is a growing tendency, unfortunately, for builders to erect houses which are not suitable for using gas; I refer, of course, to the flueless house, which has put a premium on electric heating, using panel or flat fires. Inasmuch as Mr. Chandler pays 5s. for a lighting point, does he impose any requirements that gas and no other form of illuminant shall be used in the particular room concerned? Also, does he find that the payment of £3 per house is the most favoured by the builder? It is said that 18,000 houses have been carcassed on those terms and that his undertaking has received £56,000 payment under the scheme. That looks as though these terms are accepted in pretty well every case, but I think these terms are really for the major fit-up. Mr. Chandler gives 5 per cent. additional discount to purchasers if they have appliances installed before they enter the premises. I do not know how far down that street we can go, and my own view is that we must look to the builder for the installation of appliances or for the recom-



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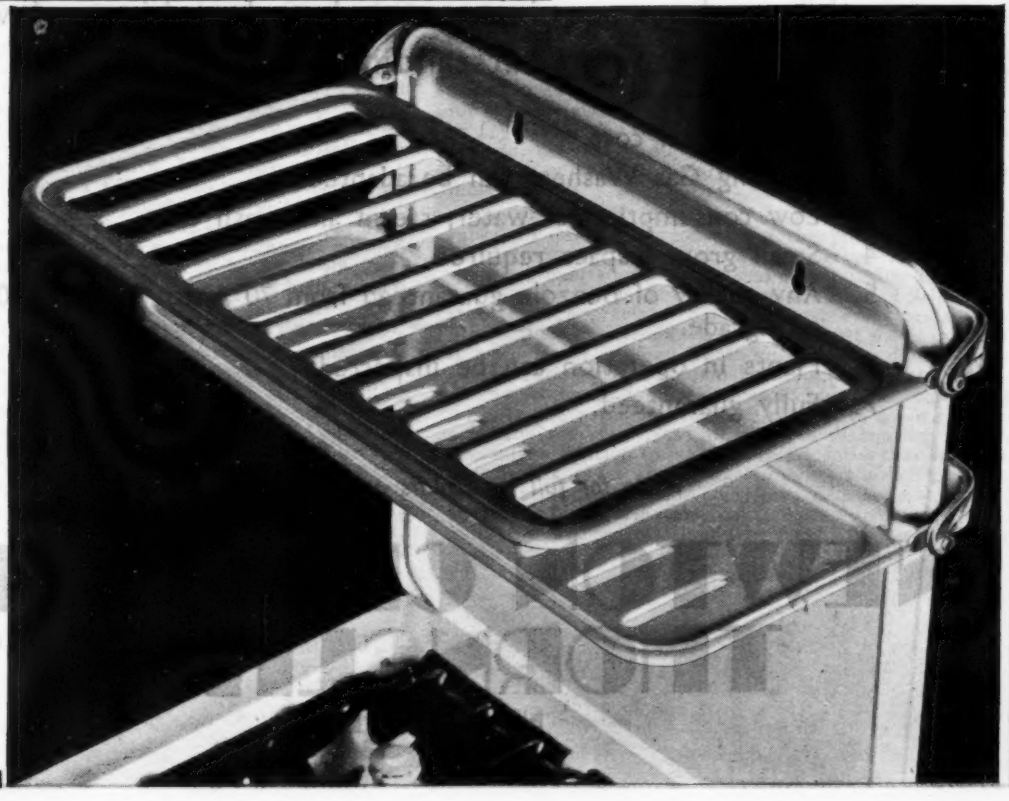

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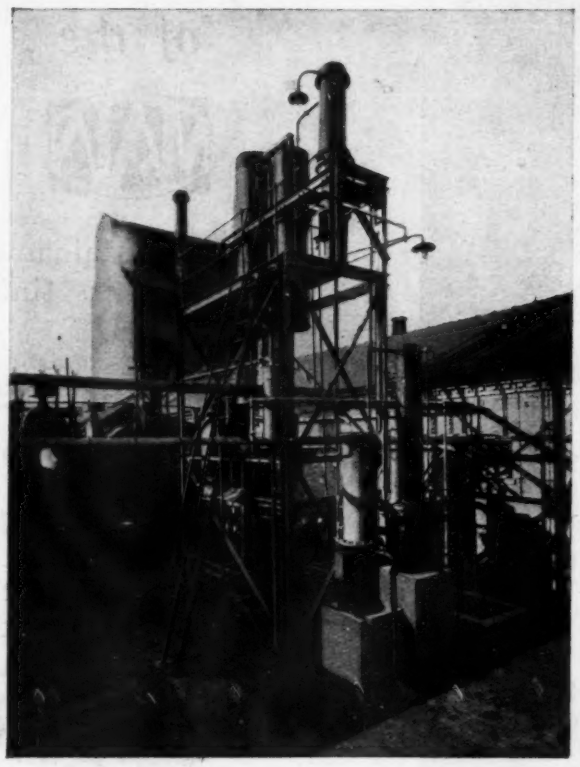

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mendation of such appliances to the eventual occupiers of the houses. We rather stress giving the builder a discount or commission on introducing a customer to us.

There is a very large percentage of coin meter consumers in Mr. Chandler's area on supply—66 per cent.—and I should like to ask if they are all of the inclusive slot rate type or whether any of them are supplied at current rate, because I think there is a tendency under Mr. Chandler's scheme, by setting back the meter in return for the appliances of new type installed, to restrict the number of cu.ft. delivered for 1d. or 1s. to such a point that it will render gas rather unobtainable to the small user. Mr. Chandler says he has adopted a completely enamelled cooker having thermostatic control, and that it may be purchased by instalments of 5s. per quarter. Does he obtain that payment through the meter by setting back, or does the collector seek to obtain the instalment at the time he empties the meter?

Industrial Developments.

Mr. H. R. Hems (Birmingham): The thorough way in which Mr. Chandler has expressed the policy of development of gas sales in the Paper before us deserves the commendation it will receive. It is one thing to outline a policy or method—another, certainly the more difficult, to carry it through, and this harder part we know Mr. Chandler and the Tottenham Gas Company are quite capable of doing. I only wish to speak briefly on section IX of the Paper, devoted to industrial developments. In the other sections Mr. Chandler has stressed the value of making personal contacts with the consumer. May I stress that it is all-important with the industrial consumer? In Birmingham, in our capacity as the Midland Industrial Development Centre, we are making personal contact with all the gas undertakings we are serving under the scheme, and we endeavour to establish more personal contact between the gas undertakings and their larger industrial consumers. We have several instances in which this has led to considerably improved relationships and possibilities of increased business. Mr. Chandler refers to migration of works to the South—it is important that satisfactory relationships should be passed on, and may I remind the fortunate undertakings in the "South" that they have a big responsibility in seeing that they continue any good work which has been done in the "North."

Movements of factories for extended accommodation within an area of gas supply is common in these more prosperous days, and it is at such times that the value of personal contact with a manufacturer is shown, when he will call in your representative to discuss the whole of his fuel requirements for his new venture.

Many industries have passed through a period of depression. In these more prosperous or "brisk trade" periods, as Mr. Chandler terms them, we are faced with a difficult form of competition. Heads of heat-treatment departments are prepared to advise their firms to spend large capital sums on electrically-heated furnaces, on reports from makers and glowing reports from America and elsewhere, ignoring all the advantages of low capital and running cost of the modern gas furnace even when fitted with automatic control. Results of the new installation are in many cases compared with old gas furnaces, to the detriment of the latter. I believe this phase will find its own level—it would have happened a year or two ago but for the depression. We have to fight this subtle and difficult form of competition with every advantage we can claim, and while in some cases we may have to submit to the loss, our personal contact, if retained, will help, especially when some of these firms come to the time of "counting the cost," as many of them surely will.

The one instance of improved efficiency of apparatus, leading to the regaining of lost prestige and what might have been lost consumption, referred to by Mr. Chandler, is typical of many which might be quoted by gas undertakings serving industrial areas. I note that Mr. Chandler makes mention of using all the assets attributable to the use of gas. I, of course, agree that we must develop the efficiency of the furnace or other industrial appliance to the fullest extent, providing it does not become impractical, but I do hope we realize that with competition so keen, there comes a point in negotiation for industrial business when furnace efficiency, the advantages of cleanliness and convenience, and all the other assets that we claim, stop (this point varies with different processes), and we are up against the question of economic values of gas as a fuel or, more bluntly, "price." The price of one of our principal competitors is fairly uniform over the whole country according to quantities taken. Our prices for gas vary considerably in different areas. The Technical Committee operating for the various industrial centres is doing extremely valuable work in taking a number of standard large heat-treatment applications—central heating and bread baking are examples—and advising subscribing gas undertakings the price at which gas should, if possible, be sold to compete with other fuels for these operations. I am glad Mr. Chester has referred to the value of night load at special rates.

Building Developments.

Colonel W. M. Carr (Stretford): With reference to the work of Mr. Chandler's undertaking in connecting with building developments, I note that they have a scale of rebate which is perhaps, while not being in terms the same, on similar lines to one which we have been operating at Stretford for some years. We have classified the houses according to the appliances that the builder would install in the first instance. Sometimes, of course, the builder would not agree in the first instance to provide for apparatus beyond the ordinary cooker and copper, and we have found it most advisable to vary our terms even for that where the cooker is installed as the sole means of cooking in the house. I should like to ask whether Mr. Chandler's Undertaking has found it necessary or desirable to meet the case of a builder who will provide for gas only for cooking purposes.

Reference is also made in the Paper to fixing up demonstration houses on building estates. Are those houses taken over by his Company, or do they use the demonstration houses which are normally arranged by the builders themselves, who possibly contract with a furnishing company to furnish the houses, in the hope of selling furniture, and where the builders might allow the gas undertakings and sometimes the electrical undertakings to install appliances and to catch business in that way? We are finding it necessary to purchase a demonstration house on an estate and utilize it during the development of that estate, selling it afterwards. If we are to demonstrate to the public as we feel we should do; and if we are to devote all our energies in that demonstration house to selling gas, it is desirable that the house should belong to the gas undertaking. I should like to stress this point because it is really quite a cheap means of advertising. If you buy a house on an estate in a neighbourhood where houses are likely to sell easily afterwards, you can fit up the house and install your salesman there; he can be on the look-out at the estate, and he will be there only to demonstrate the sale of gas. If, on the other hand, a gas salesman is installed in a builder's demonstration house, where he may be interfered with, his task is not so easy. A gas undertaking need not lose very much money in buying a house for this purpose. Assuming the price of the house is £400 or £500, when the estate is fully developed the house could be sold, even at a slight loss, which should not be more than £40 or £50. But the advertising value is very great indeed.

One other point to which I should like to refer is that raised by Mr. Hems concerning the publication of comparative costs of gas. I am always nervous, indeed, more than nervous, about the danger of publishing the cost at which gas must be sold, because the more I sell gas the more do I appreciate that in almost every instance the prices which can be obtained for gas must inevitably vary. A price which is based, shall we say, on a B.Th.U. comparison and on an assumed maximum output is very dangerous; and it is very dangerous indeed in central heating, because with solid fuels we can get to a low cost with a maximum output, but in no form of heating does the demand in relation to maximum vary more than in central heating. That is why comparisons on the B.Th.U. basis are so very dangerous. Therefore, I do suggest that the very valuable information that has been distributed by the industrial gas centres should be used with discretion and caution.

Waste Heat Recovery

FROM RETORT SETTINGS

By Major W. GREGSON,

M.Sc., M.Inst.C.E., M.I.Mech.E.,

Technical Director of Spencer-Bonecourt, Ltd.

Mr. F. M. BIRKS (London): I am sure that I am expressing the feelings of all present when I say that this Paper is a very useful and interesting contribution such as one would have expected from Major Gregson, who has made the waste-heat boiler, if not a complete life study, the study of a considerable proportion of his professional career.

The Paper sets out so completely all the essential data required when considering the question of the utilization of the process heat of carbonization, and, moreover, the operation of waste-heat boilers has proved so simple in practice that points of criticism or comment can only be of a minor character. From his remarks in the course of the Paper it would appear that Major Gregson does not generally expect to get a lesser air infiltration in horizontal settings than about 200 per cent. in excess of that required for complete combustion. A little further on he quotes a figure of 100 per cent. excess air with vertical settings. These figures represent a CO_2 content of 9·5 per cent. and 12·5 per cent. respectively.

Even when installed in existing retort houses of some age, designed before the use of waste-heat boilers was contemplated, it is possible to obtain and maintain with either a horizontal or vertical system a CO_2 content of between 14½ per cent. and 17 per cent. which represents excess air infiltration of only 30 per cent. to 60 per cent. Such results are not often obtained on the initial tests of boilers but are due to careful eliminations of air leakage and a constant check on the working results. In these days when it is necessary to strive to obtain the last possible degree of economy, it would be a pity to remain content with less than the best results possible.

Section IV, dealing with the recovery of the sensible heat in the discharged coke by means of dry quenching plants, rather presupposes that such plants can only be applied to coke ovens or horizontal settings. The system is, however, being applied to intermittent vertical chamber ovens at Southall, but the plant is not yet complete, so that no details as to working results can be given. Its application to this type of plant would appear to have possibilities as far as the Gas Industry is concerned. It is gratifying to hear that such an authority as Major Gregson now also advocates the use of larger diameter shells for a given heating surface to ensure that the steam leaves the boiler in a dry state.

Plate 1 does lead one to conclude that the inlet of feed water should be at the gas inlet end of the boiler, and the steam outlet should be at the gas outlet end, so as to reduce as far as possible the high rate of evaporation of the first foot or so of the boiler and to draw off the steam from above the least disturbed water surface. I had the opportunity recently to investigate at first hand tests on a new type of waste-heat boiler, fitted with sinuously formed tubes. This arrangement results in a very compact boiler, the shell being only about half of the usual length. The tests proved satisfactory and no priming was experienced, although I would qualify the latter statement by saying that the rate at which the boiler was steaming priming would not have been expected in a boiler of orthodox design. The new type offers advantages in regard to the space occupied, and does not appear to suffer from any disadvantages in operation.

Typical Results.

Colonel W. M. CARR (Stretford): The figures given by Major Gregson in Table 4 represent, as he indicates, typical results. I should like to suggest, however, that perhaps, so far as horizontal working is concerned, they do not indicate the highest possible, even with regenerators. At Stretford we are working horizontals with regenerators of very large area, and I give figures to compare with those in Table 4. Major Gregson gives a figure of 2½ to 3 cwt. of producer coke per ton of coal carbonized, equivalent to from 12·5 to 15 lb. per 100 lb. of coal carbonized; the average figure at Stretford, on silica settings, is 13 lb. per 100 lb. of coal carbonized, or 2·6 cwt. per ton of coal carbonized. So that that conforms with Major Gregson's figures. Under normal working the temperature at the inlet to the boiler is 510° C., and the temperature at the outlet, 212° C. (These are average figures.) The percentage of excess air is on the average higher than was suggested by Mr. Birks; we do not find ourselves able to keep the average lower than 115 per cent. With that, the steam raised per lb. of producer fuel is 3·2 lb. (from and at 212° F.), showing an extraction efficiency of 91 per cent. Those figures are representative of normal average working.

Efficiency tests on the horizontal silica settings show that from 42 to 43 per cent. of the sensible heat in the waste gases leaving the combustion chamber is recovered by the regenerators, in transmission to secondary air. In a test over a period of 24 hours, the sensible heat in the waste gases entering the regenerators was 24,820,000 B.Th.U., and the sensible heat in the secondary air leaving the regenerators was 11,622,800 B.Th.U., showing a regenerator recovery efficiency of 42·8 per cent. The heat recovered via secondary air was 18 per cent. of the total heat used in carbonization, and the heat recovered via the waste heat boiler was 26 per cent., giving a total recovery of 44 per cent. of the total heat used in carbonization.

On those figures, I would suggest to Major Gregson that there is an advantage, in horizontal working, of combined regenerator and waste heat recovery. A greater advantage could not have been obtained if one were working on waste heat recovery alone; therefore, it should not be thought that it is desirable not to endeavour to recover the maximum amount in the air provided for combustion and returning to the settings, and that we can leave the waste heat afterwards to be waste heat.

A point which I think Major Gregson might reasonably have stressed in his Paper is the enormous advantage of mechanical draught in carbonization. Those of us with experience of the operation of any type of setting with natural draught and who have worked similar settings with waste-heat boilers, appreciate the difference in control; and while comparisons of actual figures are difficult to get to show the advantages in regard to fuel, of mechanical draught as against natural draught, I suggest that on an average, taking a period of a whole year, it is somewhere between 7 and 10 per cent. That alone justifies, in my opinion, the utilization of waste-heat boilers. So great is my belief that, with absolute confidence and with real economy, I have placed waste-heat boilers, with mechanical draught, on small continuous vertical settings of only two retorts. As a practical, technical contribution to our proceedings, Major Gregson's paper is extraordinarily useful and instructive.

The Art of Recovering Waste Heat.

Mr. P. ST. GEORGE KIRKE (London): I think the Paper by Major Gregson is a very clear *résumé* of the present state of the art of recovering waste heat, and should be very helpful to many. When, in 1918, I designed and patented the boiler described in this Paper, its only fault, in my opinion, was the great length of the tube relative to the bore. However, there was then no remedy, as I had found experimentally that with mean gas velocities of 70 ft. per second, in order to get 94 per cent. of the theoretically possible temperature drop, a clean tube, 1¾-in. outside diameter, had to be at least 18 ft. long, and a 2-in. outside diameter tube at least 21 ft. long; and even then the transmission efficiency was affected by a rise or fall of the mean gas velocity.

The curve shown in Plate 1 of the Paper is correct for a definite mean gas velocity, which is not stated, but if that velocity were halved, every point on the curve would be altered except the first one.

The use of high gas velocities was rendered necessary for several reasons:

(*a*) To reduce the boiler diameter and enable it to be installed in restricted spaces.

(*b*) To carry most of the dust reaching the tubes through them.

(*c*) To reduce the temperature of the gases entering the fan as much as possible, so that the latter had to handle the minimum volume.

(*d*) To arrive at a low capital cost.

Therefore, the only way open at that time to reduce the tube length was to substitute two passes for one. That had the following objections:

(1) It increased the necessary diameter of the boiler by 50 per cent.

(2) It doubled the number of tubes to be brushed on the gas side.

(3) It necessitated the gases being accelerated twice at the inlet of the two tube nests instead of once, which increased the mean draught drop by 33 per cent. for the same velocity.

(4) It increased the cost.

The " Sinuflo " fire tube waste-heat boiler placed on the market by Messrs. Cochran & Co., Annan, Ltd., represents a considerable advance on the older type of boiler described in the Paper, in that it is fitted with 2-in. tubes only 9 ft. long, which has the following advantages:

(*a*) The shell can be made in one ring, and therefore there are no central circumferential joints to leak.

(*b*) The number of tubes to be brushed is reduced by 26 per cent.

(*c*) The minimum space between the tubes is increased to 1¼ in. both vertically and horizontally, which enables double the area of the inlet tube plate to be water-cooled in the vicinity of the tube ends.

(*d*) The circulation of the water in the boiler is twice as fast and its path less restricted.

(*e*) Nearly all the causes of tube leakage are entirely removed.

(*f*) Water circulators to prevent strains when a boiler is started up are quite unnecessary.

(*g*) The efficiency is at least as high.

(*h*) The radiation loss is less.

(*i*) It is much more robust in construction.

(*j*) It can be fitted into still more restricted sites.

Slightly Waved Tubes.

" Sinuflo " tubes are very slightly waved, but owing to the fact that they do not sag, it is possible to see as much daylight through them as it is through the old type of long, straight tube. A ball or sphere will fit a waved tube at any point, and therefore, all the known forms of brush, scraper, and drill, provided they are made ball-shaped, will operate in a " Sinuflo " tube as easily as the standard tools in straight tubes.

In the Dover boiler, when steam was first raised, the bottom of the shell became hot as rapidly as the top, which was proof that the circulation of the water in the boiler was very much faster. Of course, after a boiler has once steamed, there is no trouble; but in the past it has been very difficult to prevent strains being imposed on a boiler when starting it up, and before steam was being emitted. In some of the old type boilers we could arrive at a steam pressure of 120 and even 150 lb. per sq. in. and yet find the bottom of the shell stone cold. That gave rise to the severe strains which Major Gregson has mentioned in his Paper.

With regard to the amount of water surface required for the liberation of steam, it is very interesting to note that in some of the boilers used in our battle cruisers the speed of steam off the water surface is 50 ft. per minute. In the type of boiler described by Major Gregson, and also in the " Sinuflo " boiler, the speed is never allowed to exceed 10 ft. per minute—*i.e.*, one-fifth; and in the boiler mentioned by Mr. Birks, the speed was actually less than 5 ft. per minute. Therefore, there is no difficulty, from the point of view of wet steam, in reducing the length of the boiler. It is evident that the rate at which you can get steam off the boiler without priming is a function of the velocity of water circulation. I take it that the rate of water circulation in the boilers used in our battleships is at least five times as fast as that in the boiler described in Major Gregson's Paper, and that is why steam can come off the water surface five times as fast in the battleship boilers. In this new boiler the water circulation is at least twice as fast as in the old boiler, and therefore, presumably, if it were necessary, it would be possible to take steam off the water surface at a speed up to 20 ft. per minute, and still get dry steam.

I was very interested in Major Gregson's interesting calculation, in Part VI of the Paper, in which he endeavours to divide the transmission of heat by radiation from the transmission of heat by convection. That is a very difficult thing to do. It is of great importance in connection with superheaters, and I should be very grateful to Major Gregson if he would give us some idea of how to effect that division.

Figures from Brighton.

Mr. D. L. Browne (Brighton): I should like to add my personal congratulations and also those of my chief, Mr. Corfield (who is unable to be present and on whose behalf I am speaking), to Major Gregson for his very interesting and informative Paper. At Brighton we have eight of Major Gregson's boilers working on horizontal settings, and our results correspond very closely with those given in the chart in the Paper, which chart gives curves for steam yield. The inlet temperature at our boilers is 450° C., and our analysis corresponds to 150 per cent. excess air. On the chart, that gives about 2·1 or 2·2 lb. of steam per lb. of producer coke from and at 212° F.; we get 2·2 lb., from and at 212° F., per lb. of producer coke, which is equivalent to 28 lb. of steam per 100 lb. of coal carbonized.

We are very interested to see from the chart the very great increase in steam obtainable for any increase in the temperature of the flue gases. Apparently it amounts, roughly, to 1 lb. per lb. of producer coke per 100° C. increase of temperature of the flue gases, or 13 lb. of steam per 100 lb. of coal. In that connection we are thinking of experimenting by by-passing a portion of the regenerators in our settings, with a view to boosting up the temperature of our waste gases and increasing the steaming of the settings. It would be interesting if Major Gregson could give any information as to the results achieved by so doing on horizontal settings.

Also, can he say a little more about the " make-up " producer gas in waste-heat boilers, which he mentioned in Part VII of the Paper? Or is that matter outside the scope of the Paper? He may have meant the use of an external producer.

With regard to Section V of the Paper (improving the effectiveness of waste heat recovery), we have had a lot of bother from air leakage and radiation, the air leakage being detected by CO_2 readings along the flue. We have overcome the leakage trouble very largely by concreting-in the waste gas flue externally. The radiation trouble has been overcome by putting a 4-in. antithermic lining along the length of the flue. We have had an antithermic lining in the walls of the flue, but evidently that was not efficient, and we have secured quite a big improvement by adding another 4 in. of lining. I was interested also in Major Gregson's remarks concerning the troubles due to flues being on wet soil, and so on, because our Works are situated right on the sea shore, and that probably accounts for quite a lot of our temperature drop. The best we have been able to do so far with the concreting and with the antithermic lining is to reduce the temperature drop to 50° C. in a flue the total length of which is 50 ft.

In Section VII (economics of waste heat recovery on retort settings) reference is made to the quantity of steam required on a Works which, it is said, has been given by various authorities as varying from 800 to 2,000 lb. of steam per ton of coal carbonized. Major Gregson says it is quite normal practice for the waste-heat boilers on the retorting plant to deal with all the Works steam and power requirements, assuming the water gas plant be self-supporting. We get 28 lb. of steam per 100 lb. of coal—*i.e.*, about 630 lb. of steam per ton—and in our case that amounts to only about half our total requirements, independent of the water gas plant. In Section III of the Paper (flue gases from retort settings) he gives a figure of 36·5 lb. of steam per 100 lb. of coal carbonized—*i.e.*, 820 lb. per ton. So that it is rather at the lower end of the suggested range of requirements.

With regard to the fans, Major Gregson mentions the alternatives of steam or electric drive. We have found that the big fluctuations in Works load causes to some extent corresponding fluctuations in the steam pressure available, and that has given trouble in the way of fan speed variations. When the steam pressure is down, the speed of the fans tends to drop. At any rate, we have found that in our case electric drive is preferable. Also, the electrical drive requires less general care and maintenance.

We have had a certain amount of internal corrosion in the outlet stacks of the waste-heat boilers, and on examining some of the deposit inside the stacks we have found that it has quite a large sulphur content. I do not know whether that indicates that there should be some sort of brick lining, or something like that, to the outlet stacks, but I should be glad to hear whether others have been bothered with the same trouble.

Colonel W. M. Carr (Stretford): I apologize for inflicting myself again upon the meeting, but there is a point I should like to mention, arising out of the remarks of the last speaker. He indicated that the electrical drive was desirable for the fan in the waste-heat boiler. It has paid me, however, to scrap the electric drive and to install a high-speed steam engine in its place. I was buying current at 0·6d. per unit, and the annual saving effected by substituting the high-speed steam engine drive for the electric motor drive was well over £280; so that I made a good return on the cost of the change-over.

I should like to suggest also to our friends at Brighton that, before cutting out the regenerators, they should concentrate still further upon this question of air infiltration, as others have done, because from my experience of horizontal settings I have found that a leaky sight-hole in

a bench of 10 beds of retorts—*i.e.*, 100 retorts in all—will increase the excess air in the waste gases from those 100 retorts by as much as from 7 to 10 per cent. Therefore, I suggest that, largely by the training of the retort house staff to ensure the absolute prevention of air infiltration, it is possible to work horizontal retorts with an average excess air not exceeding 110-120 per cent.

THE AUTHOR'S REPLY.

Major GREGSON, replying to the discussion, said: First of all, I should like to thank Mr. Birks for his remarks. He has an enormous amount of operating experience on waste-heat boilers. I do appreciate what he has said about the problem of excess air, particularly in the Gas Light and Coke Company's plants. But a good many of these problems are really local; there are certain lay-outs and designs, and so forth, and particularly certain flue arrangements, with which it is very much easier to maintain a much higher CO_2 figure and a much lower excess air content, and thus less dilution. The result is that on Mr. Birks' installation generally the inlet temperature of the waste gases is a good deal higher than that which maintains in many other installations, and the resultant yield per ton of fuel is higher.

I think Mr. Birks and I are in agreement, as a matter of practice and experience, as to what will be the correct steam release figures for a particular job. It is a much more complicated issue than mere calculation, because so much depends on the nature of the feed water. The bulk of the feed water in a gas-works is make-up feed, which is generally treated nowadays. It has certain salts in solution which tend often, if not to prime, to bubble.

With regard to feed inlet, Mr. Birks seems to favour putting the feed in at the hot end of the boiler, where the maximum amount of work is done. In the course of my experience I have tried feeding in almost every part of the boiler. I have tried feeding at the top, by means of a spray, I have tried with a long tube back to the centre, and at the back end and even at the bottom; and although different factors arise during the early stages of raising steam, my experience is that when the boiler is actually steaming it does not matter very much where you feed it, because circulatory currents are set up and once the water gets in it travels around at a good speed.

I think that Colonel Carr was one of the first gas engineers to give serious consideration to waste heat recovery on horizontals on a large scale, and he has had a good many years' experience. The excess air figures at Stretford are fairly low, but the figures he gives are slightly higher than the chart figures I give in the Paper. That is due to a number of reasons, which I have given in the Paper. I do not think I can quite agree his figures for horizontals, which show 18 per cent. recovery on secondary air and 26 per cent. recovery on waste-heat boiler, which means a total recovery of 44 per cent. On the face of it, they seem rather higher than the figures I have given for verticals—just over 40 per cent. On the other hand, with verticals, to get a true comparison, we must also allow for the fact that we have preheated our secondary air without touching the waste gases at all. In other words, we have taken sensible heat out of the coke and have also reduced the radiation loss by bringing the gases through the hollow walls. Therefore, so far as I can see, it seems that we are not quite speaking on the same basis when we are giving our figures.

I was glad to hear Colonel Carr uphold the use of mechanical draught, because in the early days of waste heat recovery one of our biggest troubles was to get people to realize that mechanical draught was an advantage rather than a disadvantage to the operation of the settings.

Reference has been made by Mr. Kirke to Plate I, where I have given a curve for the release of steam in a tube. That particular curve was taken from a series of experiments carried out a few years ago, when we wanted to go further into this question of heat transfer in tubes, and, secondly, the distribution of the steam liberation along the length of a straight tube. Actually, the figure I have given is for a mean velocity of a little over 70 ft. per second. I do not quite agree with Mr. Kirke when he says there is a big variation at different velocities. I see from my notes that at 90 ft. per second the only difference was 1 in 67, which is less than 2 per cent. on the position of the curve, and I do not think that really matters because it is as near as one can measure in ordinary practice.

I have listened with great interest to his remarks on the "Sinuflo" fire tube boiler; but it is a comparatively new boiler, and one does not wish to criticize it. It seems to me, however, that the essence of the waste-heat boiler is that it should fulfil the conditions which experience has shown to be necessary. If any boiler fulfils all the conditions, it will be a good boiler. On the other hand, if years of constant running show that there are defects, it will not be a good boiler.

Steam Release.

The question of the steam release from the water surface is an important one. If you are shortening the boilers, you are, naturally, increasing the liberation per unit of surface, and to support his remarks he has referred to the steam release on the battle cruiser boilers. I happen to know something about those boilers, and quite agree that the steam release is at a speed of about 50 ft. per minute; but the steam comes off in such an entirely different way that I do not think Mr. Kirke's argument will hold. About half of the ships have the Babcock marine boiler, which has its drum at right angles on board ships, parallel with the headers, and at right angles to the tubes. Actually, the water in the drum does not evaporate at all; that water, under any conditions of steaming, is absolutely steady. The whole of the steam comes from the back areas through the return tubes into the separating chamber, where the water is thrown down and the steam thrown up. In other words, to speak of the liberation per sq.ft. of surface in that type of boiler is quite wrong, because the circulation is going in another direction.

Again, in the Yarrow type boiler we have a series of tubes, which are throwing up their water, along the whole length of the drum. That is quite a different thing from a tubular boiler where 70 per cent. of the work is done in the first 3 or 4 ft. of the tube. The real trouble in a fire tube boiler, if you have used dirty water—and if you crawl inside after it has been closed down you will appreciate it—is that a lot of silt and dirt collects at the front end, because the natural circulation is such that the water banks up in the front area and the surge backward leads to bubbles in the boiler, so that you have to reduce steaming so as to get a reasonable chance of clearing the water of the steam. That does not occur in the Yarrow type boiler, because it has a perfectly even distribution; even up to five or six times normal rating there is still no surge, no difference in the vertical height in the different parts of the drum. That is the essential difference between the marine water tube boiler as we know it and the fire tube type of boiler, and we must remember that when we are trying to compare them on a basis of dryness or otherwise of the steam.

With regard to the division of heat transmission by radiation and by convection, a good deal of work has been done during the last few years, particularly by the National Physical Laboratory, in connection with this subject. You are probably all familiar with the recently published work of Dr. Margaret Fishenden and Dr. Saunders. But the figures I have got, and on which I have based by remarks, were obtained from experimental work by my own firm, in which, by cutting out contact heating surfaces at different stages, we were able to get a pure radiation effect; then, by adding contact heating effect stage by stage, we obtained a series of curves giving a very good approximation to the difference between contact heating effect and radiant heat absorption. The laws have been known for years; but what probably has not been known is exactly where radiation effects begin and end, and where the change-over occurs to contact heating effect.

Effect of Temperature on Steam Recovery.

I would thank Mr. Browne for his remarks regarding the experience at Brighton. I agree with him when he refers to the extraordinary effect of temperature, especially in horizontal retort practice, on steam recovery, because, as I pointed out, when we are dealing with such a low heat gradient, 10° or 15° or 20° C. makes an appreciable difference to the steaming.

He asked what would be the result of cutting out parts of the regenerators. The net result would be, probably, to increase the producer coke consumption by 1 lb. per 100 lb. of coal carbonized; but against that he would pretty well double his yield of steam, because he would double the temperature drop through the boiler.

The make-up producer gas constitutes a problem in itself; as I have suggested in my Paper, it is well worthy of a separate Paper, because it is quite a big problem, from both the engineering and the purely commercial points of view. I have deliberately left it out of my Paper, and would prefer not to bring it into the discussion, because it is getting rather off the subject of the Paper.

I was very interested in the fact that Colonel Carr and Mr. Browne expressed diametrically opposite reasons for the adoption, in the one case, of electric fan drive, and in the other case steam drive. Mechanically, they are equally effective, and it is really a matter for each gas engineer to decide, on the basis of his own particular installation, which is the better.

Then Mr. Browne made reference to corrosion in uptakes,

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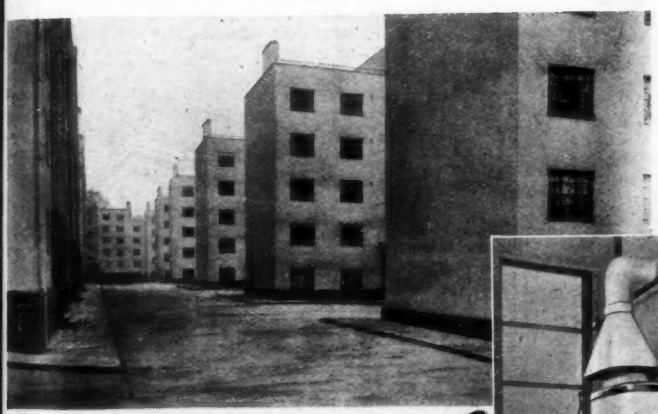

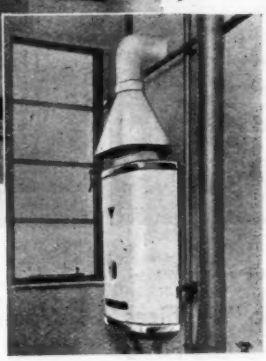

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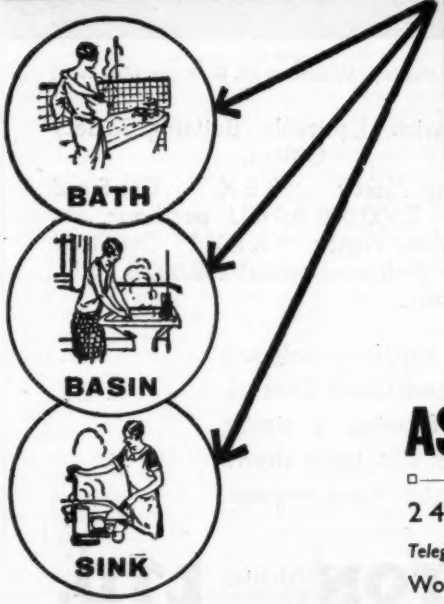

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which is a factor to be guarded against. It is extraordinary that for many years we had no trouble of this sort, except in some extreme cases, whereas the trouble has been more marked during the last few years. I think it is due to the fact that you are using more water or steam in the producers than you did previously, because you are using lower grade fuel. The result is greater separation of gases and a bigger deposition of sulphur and sulphuric acid as the gases pass through the return. The gases leave the boiler at an average temperature of 200°-240° C., so that by the time they are through the fan and on the way to discharge the temperature is 180°-190° C. It is a matter of either treating the ducts with anti-corrosive compound or suitably draining them so that there is no tendency for acid to lie up and get away to the chimneys.

The Preparation, Marketing, and Utilization of Coke

By W. L. BOON, M.I.Mech.E.,

Manager of the London and Counties Coke Association

Mr. R. J. RESTALL (Stalybridge): Our experience at Stalybridge bears out the Author's contention that "sales are sensitive to quality" and also that "there are remunerative and increasing markets for gas coke." I would like to refer to remarks in the introduction and suggest they need careful study. Those who do not agree that a gas-*cum*-coke policy is a wise one may possibly have overlooked the fact that there are yet jobs best done with coke. Also there are people, and quite a large number too, who cannot afford other fuel, and again there are those who even prefer coke to other forms of heat. Unless we go out for this valuable market by producing a first-rate fuel and putting that fuel before our customers in an attractive manner, as Mr. Boon points out, we may find that other smokeless fuel producers are in the position of describing themselves as the premier fuel suppliers in this country.

Entirely apart from increases of coke used by reason of improvement in quality, there is the important factor of design of appliances. It may be fairly said that scientific methods of consumption more or less recent have produced better results from a less amount of fuel; such methods are responsible for and will so continue to alter our outlook and our scheme of sales distribution. We are perhaps too haphazard regarding our dealings with coke users, they require as careful attention as the value of the fuel demands and as that value increases, so must the attention. In our own case for the last financial year the return for coke amounted to 11·9 per cent. of the gross revenue after having allowed for all charges against coke production. The Author has split his Paper into three definite parts, and in dealing with "Preparation," I am convinced that dry-cooled coke in some form or other will satisfy modern demands for the time being. There are several reasons why dry-cooled coke should be placed on the market. It is probably the cleanest fuel made, it is better value for money than quenched coke from the technical as well as purely domestic view point, it is harder and therefore stocks better, and is not so absorbent as some other types, also it may prove, if the system of cooling is a good one, of money value to the works. Against the dry cooling process there is perhaps the objection of dust formation, and further, it is thought that a skin forms on the outside surface of the coke, which I believe does not aid combustion. A free from moisture coke, however, may compensate for this possible defect.

With reference to the handling of coke, the Author's statement suggests that coke must be handled gently; this does not appeal to me. I believe it better that the coke should be manufactured of a hardness sufficient to withstand rough treatment, so that as much as possible of the smalls and breeze are produced and eliminated before the coke is actually ready for delivery to the user. On this point of breakage as well as friability and degradation, the shatter tests of the coke to be dealt with are a valuable help in the design of a plant. I agree that debreezers are a valuable addition to enable us to prepare dustless coke. The ash content, as the Author points out, is very important and in our own case we produce coke having a content of about 8 per cent. I am, however, rapidly forming the opinion that modern requirements demand something better. Also there is oven coke on the market with lower ash contents.

On our Works (150 millions per annum) for the last financial year the cost of handling, which includes stocking, cutting, screening, bag filling, loading, and taking out of stock, showed a figure of 22·86d.—the plant is not a modern one, filling of graded coke being done from the ground.

Our percentages of sales of different grades of coke for the last three years show a rise in the amount of graded coke as follows: 8·8 per cent., 26·9 per cent., and 34·35 per cent. for the last financial year.

Year.	Large.	3 In. × 2 In.	2 In. × 1 In.	Total Graded.
1	2	3	4	5
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1932–3. .	91·79	·4·30	..	8·8
1933–4. .	71·79	6·72	17·24	26·96
1934–5. .	65·50	11·14	21·82	34·35

These changes have been brought about by intensive marketing schemes, improved product, and voluntary transference by users from large to graded coke. I am sorry the figures do not compare favourably with those in the Author's Table No. 7. The prices of respective grades in our district have not altered during the last three years, but by reason of our increased output of graded coke and increase in local sales our net revenue from this source increased by £700 for the last year, which supports the Author's insistence that our product coke can be remunerative.

With reference to Table No. 10, I imagine the Author will have priced his fuels on a comparative basis, but I should be glad to know how gas coke would compare if boiler slacks delivered at 15s. to 16s. a ton were available. I fear that the results, although very convincing, are applicable to places only where coke as fuel is comparatively costly.

The vexed question of nomenclature will possibly some day be settled—while we might find suitable names for our sizes the diversity of local demands makes agreement on the dimensions of a particular size very difficult. For instance, we have in our district a good demand for ¾ in. × ⅜ in., which is locally known as "riddled" breeze; it pays to take out this size because for breeze we only get about 6s. 8d. per ton, while for this special size the yard price is 15s. per ton. We have been engaged on working up a domestic market and on that account the costs of delivery, which includes bagging and loading, of necessarily small quantities to dwelling houses is very high, the average cost per ton being 12s. 7½d. over the year; this refers to bags priced at 1s. and paper bags at 6d.

In the Paper the conclusion is drawn that the sale of large coke will diminish; with this I agree, and therefore it is necessary to give more care and attention to production and preparation. On this point the makers of plant have not stood still. The enthusiasm with which the Author advocates attention to coke production and selling can easily be understood. In the Paper an astounding fact is mentioned, we supply only 0·68 per cent. of the solid fuel requirements for the open grate. I wholeheartedly support Mr. Boon in his contention that this market can be ours, and if, as we all hope, the use of gas for industrial purposes will increase, the readiest market for coke is the one on our very doorsteps. Mr. Boon's Paper is outstanding in money-making suggestions coupled with technical and statistical value.

Views from New Zealand.

Mr. F. W. J. BELTON (Christchurch, New Zealand): I have to thank you, Mr. President, for having given me the opportunity to join in this discussion. Our conditions in New Zealand are somewhat different from those obtaining here. I like this Paper; it is provocative, and that is what we want. Quite a number of the points raised are open

to question. In the first paragraph of his summary Mr. Boon states that the Industry must " recognize the necessity for and sponsor the adoption and installation of new grates." Are new grates really necessary if gas coke is to be used? I question it very much in many instances.

Reference is made also in the summary to further organization. At the risk of being very rude, I feel I must ask whether there is not a great danger of running into the American error of having too much organization, so that instead of the organization being for the benefit of the business, the business has to be run to support the organization?

In Section III of the Paper a description of dry cooling plant is given, and in sub-section (6), the Author gives costs of steam; but if you consider those figures with the figures given in Table I (Screen analysis of dry and wet quenched coke), there is a reduction of 11 per cent. in the weight of saleable coke above ⅜ in. In Christchurch we can get 43s. 6d. net at the Works for our coke. On 1,000 lb. of steam, that reduction in weight of coke saleable represents 4s. Our other costs, comparable with those given in sub-section (6) are practically double as much on account of the higher cost of capital there, and possibly our steam may cost as much as 6s. per 1,000 lb. We have to receive a considerable increase in the price of our coke in order to compensate us for that.

In Section IV of the Paper, dealing with the marketing of coke, Mr. Boon says that " the merchant is usually the purveyor of all solid fuels and it cannot be expected that he is going to interest himself in bringing the benefits of the coke fire to his customer's attention. . . ." That is so. It is also stated that the coal merchant is more or less unbiassed; but I do not quite agree, because usually the coal merchant makes more profit out of a bag of coal than he does out of a bag of coke.

Reverting to the problem of the open coke fire, I do not think everybody realizes the capacity and value of the open domestic fire as a market for coke. Mr. Boon is wide awake to the value of the domestic market, but he rather thinks that we must have special fires for it. That depends; some people go to extremes and say that a fuel must contain anything from 12 to 15 per cent. of volatile matter before it will light easily. That, however, is not our experience. We are sending out a coke containing about 3½ per cent. volatile matter and 8½ per cent. or 9 per cent. of ash, and if that is sized correctly we have no difficulty in burning it in the majority of open fireplaces. That that is so you will realize when I refer to advertising.

Coke Advertising.

The normal coke advertising is wilfully inadequate and futile. You can use newspapers, posters, picture screens, and leaflets *ad infinitum*, and the results will be negligible. Most people will not expend the price of a bag of coke upon an experiment. There is only one way of bringing coke to the notice of the domestic consumer, and that is to give him a working sample. If our experience in Christchurch is to be regarded as typical, then such propaganda needs to be done only once. Provided coke is available at a suitable price, the results of such propaganda will be cumulative, because every user becomes an enthusiastic advocate. A few years ago I was worried about coke sales. In the latter half of the winter of 1931—which is July with us—we distributed free 17,500 10-lb. paper bags of coke, and each bag was accompanied by a leaflet containing a little sales talk. Of course, several of our men had some fun over this work. A lady in one of the houses said to one of our men " By the way, you have a notice in your showroom to the effect that 'Gas is coal with the bother taken out.' Are you bringing me the bother now "? However, I will tell you the results. In 1931 we sold 5,850 tons of coke. It was only in the latter half of the winter of 1931 that we distributed these bags of coke, but in the year 1932 our sales increased to 7,000 tons. In 1933 we sold 10,300 tons, in 1934 we sold 12,400 tons; and our sales are still increasing. I should say that at least 85 per cent. of that increase was in respect of coke used in the domestic grate, and I do not think we have sold more than 50 special coke fires.

In the Paper it is stated that the domestic and industrial markets can absorb more coke than can be produced by the gas works. I wonder! How many of us have yet produced the maximum amount of coke that can be made while making for sale a given quantity of gas? We are accustomed to think in terms of so much per ton of coal or so much per thousand cu.ft. of gas. Have you ever thought in terms of total output and neglected the output per cu.ft., or per ton, and so on? I do not think that any of us have even approached the limit of our production of coke. A quantity of 40 million tons of coal per annum is used domestically in Great Britain. Judging from our experience, probably 30 million tons of coke would do the same work. The Gas Industry sells between 7 and 8 million tons of coke per annum nowadays. What is the Industry's total coke output capacity for its present sale of gas? It is probably in the neighbourhood of 20 million tons; it is quite a simple little problem, so obvious that I will not bother to tell you more but will leave it to you to think out. But we in Christchurch are working in the direction indicated; our sales were still increasing when I came away, and we can go a great deal further than we have gone so far.

Section V of the Paper, dealing with the utilization of coke, is a very valuable collection of information, for which we should be grateful. Again, I should like to congratulate Mr. Boon upon his excellent Paper.

Coke Storage.

Mr. W. W. Townsend (Colchester): The first thing to which I should like to refer is the storage of coke, which is not mentioned in the Paper. We have always to store coke, and it is usual to store it in the crude form, without previous screening or grading. I think everyone here must have experienced the great loss which results from the storage of coke. I can recommend from my personal experience the storage of coke only in the graded form, for it is of great advantage in more than one way. In the first place, it saves a great deal of breakage and loss from breeze, and in the second place, it provides a reserve upon which to draw during the winter months, when there is a very large demand for the graded fuel.

But my primary object in speaking to-day is to tell you something about the work of the London and Counties Coke Association. Mr. Boon is the chief technical official of that body, as well as Manager, and he has under him a technical staff second to none in this country. He advocates in the Paper a national scheme and regional schemes for the marketing of coke. We have heard for a great many years about the importance of coke as a residual and its influence upon our balance-sheets. We have seen numerous schemes put forward for the marketing of coke, and we have had commercial sections working in the Industry for a considerable time. I have been in commercial sections for a great many years, so that I know about them, but they do not touch the fringe of the subject, and they never have done. The work which the London and Counties Coke Association has done is unique, but it has not been recognized sufficiently. In a period of between three and four years practically the whole of the coke produced in fourteen counties has been marketed by a central organization; 43 per cent. of the total gas coke produced in this country has been sold by this organization, and it has not been an easy task. To some of us who have been associated with it from the beginning it has seemed at times an impossible task. We had to get all the different producers of coke to agree to their prices being fixed, and we had to get merchants and the factors into line. I do not think the difficulties would ever have been surmounted had it not been for the leadership of Mr. R. W. Foot, the General Manager of the Gas Light and Coke Company. He has the brain of a diplomat, and he was able to persuade and cajole everybody to work together.

This is a co-operative Association, and Mr. Boon would be the last to claim that everything he has put before you has originated from one source. We pool our experience and our knowledge, and we have a very great deal of information available as to the best methods of screening and handling, the best methods of utilization, and so on, co-operatively acquired, and we are still working at it. The object of the Paper to-day is to let the Industry know what is being done, so that those in the Industry may have the benefit of our experience if they desire it. On behalf of the Executive Committee of the Association, I want to say that we are only too ready to place at the disposal of the Industry any information that we have. It is quite impossible in a Paper of this kind to go into details about the marketing of coke; but that information is available and can be used by those in any other district who are thinking of introducing such a scheme. We are quite prepared to hand out freely the particulars of our methods. We have struck all sorts of snags, as you will realize, and we can save you a lot of time and trouble in your organizations by telling you what we have done.

Mr. Boon has very great qualifications for dealing with this subject. He is certainly an authority on coke, and especially on the utilization of coke. It must be a surprise to some people to know that we have gone so far as to offer a lump sum charge for the heating of buildings over a definite period. That puts coke on an equality with oil or any other fuel. We have arranged several contracts through the Association, with the advice of Mr. Boon and others. If a large block of buildings is being erected we can go to the architect or owner and undertake to heat the buildings for a certain sum per annum; we do the

stoking, remove the ashes, and do everything else necessary. We give you a complete system, and in various ways the problems arising in regard to the utilization of coke are being met. The point is that this policy has been successful; it has worked. Mr. Boon's Paper is full of valuable information—but there is even more information available for any who care to ask for it.

Coke Quenching.

Mr. R. N. Webb (Leeds): Mr. Boon has dealt very comprehensively and thoroughly with each of the three phases of his subject. The few remarks I have to make concern the first one principally, the preparation of coke, and particularly that portion on quenching. The process of quenching is one that is receiving a great deal of attention in the Gas Industry, particularly where the hot coke has to be treated outside the carbonizing vessel. Where continuous verticals are in operation the process is more or less a settled one and dry coke a resultant. With horizontal installations, with which I am most familiar, the handling and quenching of the coke is a most important matter. I have not had any experience with dry-cooling in bulk, but I agree that water-quenching may produce more breeze than dry-cooling.

I am firmly of the belief, however, that water-quenching can be so carried out that the difference between the two systems will not be more than 2 per cent. on 1 in. mesh by the shatter test in favour of dry-cooling. We have carried out tests on cokes, from the same coal, by dry-cooling and quenching in our usual manner and find less than 1½ per cent. difference on 1 in. in favour of dry-cooling. The average result by the shatter test on several of our different cokes, quenched in the usual way, is 89/90 per cent. on 1 in. The production of large coke is not so important to-day with us, as the cut sizes are in demand.

The Author mentions an amount of water, 1½ tons per ton of coke, as being used for quenching (not evaporated). I wish to ask if he is referring to coke-oven plants when he gives this figure. I feel sure that the majority of gas undertakings are handling much less water than this. It is probable that we shall have a quenching system in operation at New Wortley, Leeds, in the very near future, when not more than 50 gallons of water will be used per ton of coke made. The moisture content of the coke thus slaked will not exceed more than 3 per cent. to 4 per cent. This has been already proved by quenching several different batches of 18 cwt. of coke at one operation.

The question could now be asked, would you feel justified in adopting a dry-cooling plant if you were confident you could so quench your coke at an all-in cost for water, in our case of 0·5d. to 0·6d. per ton? It is possible to pay too high a price for the recovery of the sensible heat in the coke. I am of the opinion that a perfectly dry coke is neither advantageous nor necessary, and I am very doubtful of the efficacy of spraying with coke, e ther on discharge from the cooling plant or afterwards, for the elimination of the dust trouble.

With regard to the Author's remarks on breeze production, I think he is suggesting a high figure when giving 35 per cent. of low value fuel as being obtained from coke. A new grading plant was installed at New Wortley about fifteen months ago, capable of handling 20 tons of coke per hour, and producing five sizes. The total breeze produced (through ⅞ in.) by the plant over this period is approximately 24 per cent. With the remainder of this section, and with what the Author has to say regarding quality and demand in Section VII. (on the marketing of coke), I entirely agree. We have sold from the New Wortley Works during the last twelve months over 5,000 tons more coke than in any of the preceding three years, and this we attribute greatly to the fact that it has been cleaner and graded to sizes suitable for its various uses.

Co-operation of Architects and Heating Engineers.

Dr. F. M. H. Taylor (Gas Light and Coke Company): I should like to congratulate Mr. Boon on the way in which he has set out the various stages as between the production and the final utilization of coke. As one who has had the very great pleasure of working in close co-operation with Mr. Boon during the past two years, I think it is most appropriate that his work on behalf of the Association should be brought before this Institution. I recall the early days when those of us who had been working on the development of the newer appliances for burning coke were faced with a lot of difficulties in putting something on to the market and encouraging architects and heating engineers to adopt it instead of opposing it. Just at that time Mr. Boon came along with a drive and personality which I think made all the difference in bringing this work right to the notice of and obtaining the full co-operation of the architects and heating engineers.

Obviously this Paper is not intended for very close technical discussion, but I should like to make a few remarks about the results which have followed from what might be called the modernization of coke equipment. During a period of just over two years my own Company have modernized—by which I mean the fitment of new boiler plants, or automatic controls, to coke-burning plant—over 200 installations and conversions from the burning of other fuels—*i.e.*, coal, oil, and electricity. The actual conversions of existing plant number over 100, of which nearly 100 have been large steam-raising plants, such as are used in laundries, factories, and public baths. The total tonnage due to conversions alone—*i.e.*, involving absolutely new sales of coke—is 65,000 tons per annum. That is quite apart from new installations. These are all large-scale coke installations. I believe a lot of the Companies outside the London area would feel that the large-scale business—steam-raising and central heating—is perhaps not so important as the domestic boiler and the open fire market. I believe that is correct; but I should like to say here that the new policy of the Gas Industry, of attacking the water heating load with gas itself by intensive sales effort, even by new systems of gas charging, might mean, and I believe it will mean, that the coke made for sale will be used more and more in the larger scale plant rather than in the domestic coke boilers.

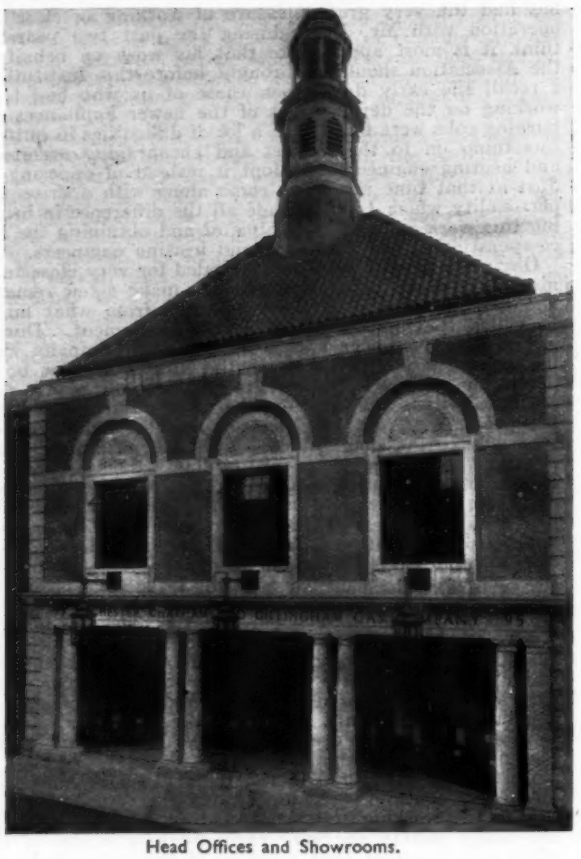
I was very interested in the remarks made concerning all-in coke contracts, because I think the very first one to be actually working here we started up only last week; we are really just in the very early teething stages of this all-in coke contract, and I believe it will prove to be the first of a number which will amount to perhaps a dozen even by next winter. My Company have already had a gas all-in contract for some months.

The introduction of new equipment to the market to benefit the sale of coke, or of any other commodity for that matter, has depended very largely on the goodwill and co-operation of the heating trade. Recently there has been very close discussion with the leaders of the heating trade, to ensure that there is no vestige of suspicion of the Gas Industry, and that we should have the full co-operation and support in this business of putting forward the very newest coke-burning appliances. That has been done, I think, by two rather simple principles—first, by broadcasting to the manufacturers and to the trade, through such people as Mr. Boon and his staff, the fullest information we have about these appliances. In other words, we have given every help and encouragement we can to them; we help with regard to design and lay-out, and we do drawing-office work for them and give them all they want in the way of assistance to get their schemes ready. Secondly, we have allowed them to do the actual contracting and to make a profit out of the installation work. Once you give any commercially-minded man the incentive of profit I do not think there is any need to worry about the results.

INSTITUTION VISITS

The Rochester Works

On Wednesday afternoon a large number of members paid a compliment to the President by accepting an invitation to visit one of the works under his control—the Rochester station of the Rochester, Chatham, and Gillingham Gas Company, of which Mr. Valon Bennett is, of course, Engineer, General Manager, and Secretary.



Head Offices and Showrooms.

The Rochester, Chatham, and Gillingham Gas Company, which is one of the South-Eastern Gas Corporation group, supplies an area of 122 square miles. There are 193 miles of mains and 37,812 consumers. Except within the Borough of Gillingham (where the Corporation are the owners of the electricity undertaking) practically all the public lighting is carried out by gas, and there are 1,774 lamps in use. Rochester Bridge is lighted by means of high-pressure lamps.

Before visiting the Works the members inspected the magnificent new head offices and showrooms of the Company at High Street, Rochester, a view of the exterior of which accompanies this article. The premises, which were designed by Mr. L. S. Crosbie, of London, were opened as recently as last week.

The Rochester works are situated on the River Medway, below Rochester Bridge, and cover an area of nearly 7 acres. Coal is unloaded into barges at Cory's Wharf, which are brought alongside the Company's wharf and discharged by steam crane direct into stores or onto the wharf. Tar, liquor, and coke are also loaded into barges alongside, while gas oil arrives by the same method.

The carbonizing plant consists of nine settings of 10 horizontal retorts, 24 in. by 16 in. by 22 ft. long, with charging and discharging machinery. Coke from the retorts is delivered into a hot coke conveyor, thence to a draining conveyor and either to the coke yard, carburetted water gas plant, or storage hoppers.

An up-to-date coke screening and grading plant was erected in 1930. This consists of cutting machine, screens to remove breeze and grade the coke into three sizes, and storage hoppers with a capacity of 200 tons.

The washing and scrubbing plant has a capacity of 4 million cu.ft. of gas per diem. In the engine room are the exhausters and blowers of varying capacities from 60,000 to 150,000 cu.ft. per hour, together with steam and gas engine driven electrical generators, which deliver current to a common bus-bar.

There are two carburetted water gas sets (with waste heat boilers) of a rated capacity of 1½ million cu.ft. per diem. The carburetted water gas produced joins the coal gas stream at the inlet of the condensers.

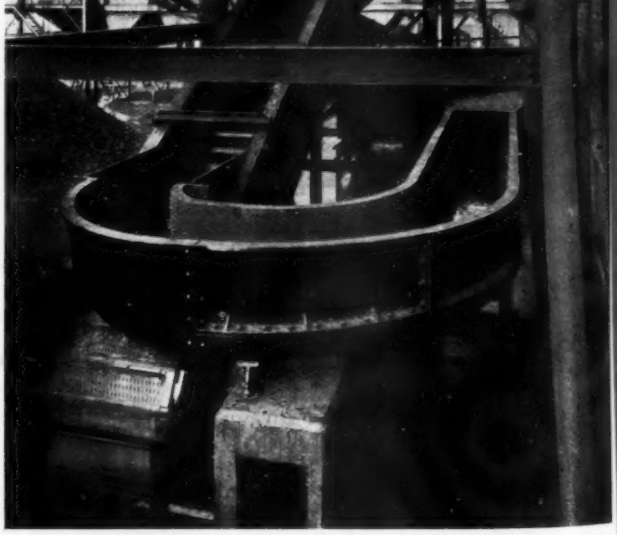
In the boiler house are four Lancashire boilers, two of 30 ft. by 8 ft. 6 in. and two 28 ft. by 7 ft. A water softening plant is installed in conjunction with the boiler plant, the greensand water entering the softener being reduced from 8° of hardness to 2° before use in the boilers.

Further plant includes the station meter, with a capacity of 150,000 cu.ft. per hour, and a safety governor house, together with station governors of the pressure loaded type for the Chatham and Strood districts.

Well-equipped messroom and laboratory are provided at the Rochester Works, the former including two bathrooms, with hot and cold shower, each man being provided with a locker. Prior to 1935 the fitters', blacksmiths', carpenters', painters' shops, and stores occupied a site at the lower level of the Works and were subject to the possibility of flooding at exceptionally high tides. New shops have since been constructed at a higher level, the ground floor being occupied by the fitters and blacksmiths and the first floor by the carpenter and for stores.

In 1923 an artesian well was sunk to a depth of 741 ft. enabling pure soft water to be obtained from the lower greensands. This water rises (without pumping) to a height above ground level and discharges about 36,000 gallons per day continuously. In March, 1935, an artesian well was sunk to a depth of 300 ft. into water-bearing chalk. The yield from the borehole is at the rate of 100,000 gallons per day, and this water is used for general purposes.

At the conclusion of their inspection of the Works, the visitors were conveyed to the Company's very fine fitting stores and workshops of the Distribution Department. These were erected in 1930, and are of the latest type.



Le Fleuve Hot Coke Conveyor at Rochester.

spacious and well lighted. Goods are kept under ideal conditions, and a continuous system of recording and checking stock is in operation.

Situated in these premises is a modern plant for gas-cooker renovation, including a muffle capable of dealing with fifty cookers per day, mechanical wire brushing plant, spray painting, &c. The compressed air available is used also for testing fittings and spraying meters. Gas fires are also spray painted and stoved with the plant available.

Other workshops provide accommodation for meter testing, blacksmith, carpenters, tinsmith, painter, glazier, &c.

Finally, a few figures relative to the whole Undertaking may be of interest. For the year ended Dec. 31 last the amount of gas made totalled 1,065,352,000 cu.ft. The amount of coal carbonized is 51,092 tons, while 371,888 gallons of gas oil are used. The coke and breeze made is 34,714 tons, together with 587,846 gallons of tar. The Company serves a total population of about 156,000.

The Wandsworth Works

On Thursday afternoon members of the Institution had the opportunity of visiting one of London's most up-to-date Gas-Works—namely, Wandsworth.

Various aspects of the Wandsworth Gas-Works have been dealt with so fully in the "JOURNAL" in recent years that little more than a general review of the plant and processes is necessary, particularly in view of the excellent descriptive brochures with which the visitors were provided. We have, however, endeavoured in the following notes to give some features of the plant, which have appeared from time to time in these pages, and which may be of interest to those who visited Wandsworth by reason of their being partly supplementary to those given in the brochure.

The Thames, the Wandle, an easy and cheap transport of coal must have constituted at least one trinity of ideas in the minds of those who, early in October, 1834, called a meeting of several inhabitants of Wandsworth and Putney for the purpose of considering the advisability of establishing a gas-works. A provisional Committee was appointed, and in little more than a fortnight it recommended to a special meeting that it was highly expedient that the parishes of Wandsworth and Putney should be lighted by gas. The Wandsworth and Putney Gas Light and Coke Company, Ltd., came into being, with a capital of £5,000.

Coal-Handling.

Water-borne coal must be counted among the secrets of the Company's success through over a century of operations, and it is therefore appropriate that we should commence our description of the works with a reference to the handling of the raw material.

In the "JOURNAL" for Nov. 14 last we published a detailed description of the lately completed coal-handling plant, which embodies the most modern methods of dealing with some 400,000 tons of coal per annum, not only for the Wandsworth Works, but also for the Undertaking's other works at Mitcham, Kingston, and Sutton, whither supplies of coal are conveyed from the chief works by road.

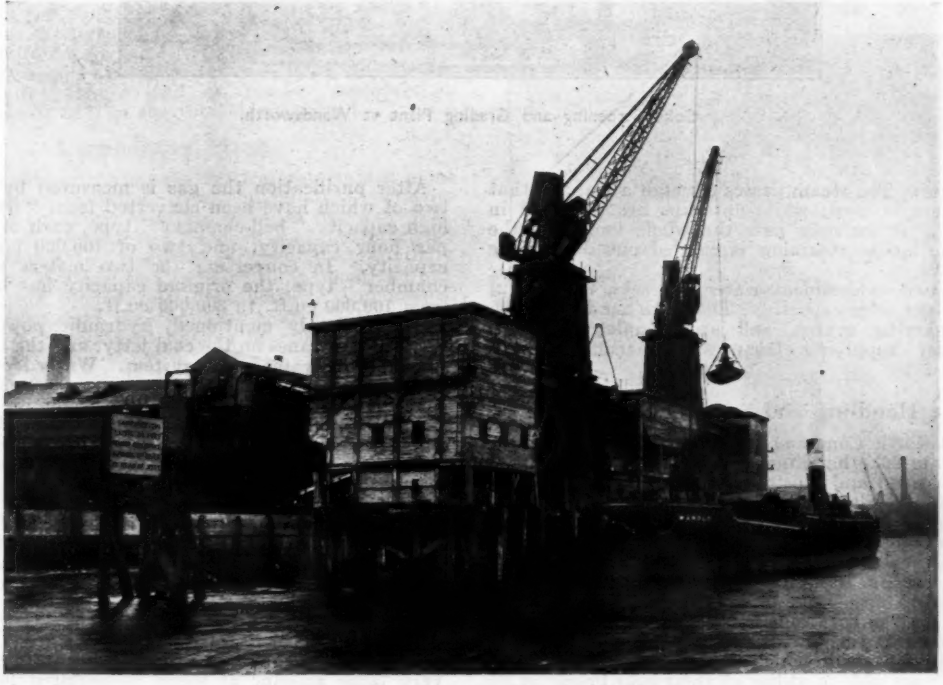
All coal supplies are water-borne by one or other of the Company's colliers, the largest of which—the "Wandle"—has a capacity of 2,250 tons. The colliers draw up alongside a jetty which has been constructed some little way out in the stream. On this jetty are a central bunker of 600 tons capacity and two 300-ton bunkers, interconnected by means of belt conveyors. Two hydraulic cranes, each capable of lifting five tons of coal per grab, can feed into any of these bunkers. The coal then passes from the central bunker onto a 200 tons per hour belt conveyor, which carries the coal to the shore across a girder bridge and deposits it in a 150-ton steel receiving bunker, whence it passes by means of further belts and bucket conveyors to the various retort houses or stores. There is storage accommodation for 50,000 tons of coal, which is equivalent to about seven weeks' consumption at full capacity.

The safety devices form an interesting feature of this coal-handling plant, including a novel form of "delayed starter" whereby the plant does not commence to operate immediately the starting handle is moved, but a loud warning bell sounds for 30 seconds or so, giving anyone working on the plant ample time to get clear. In addition, a number of switches are placed at convenient positions throughout the system, illuminated at night, so that in case of emergency the whole plant can be instantly brought to a standstill.

Gas Producing Plant.

The intermittent chamber oven plant consists of 66 ovens, 36 of which were seen at work on the occasion of the Institution visit, while the second battery of 30 are in process of re-setting.

The chambers, which are of silica and constructed of tongued and grooved blocks, have a cross-section of approximately rectangular form, with rounded corners and sides slightly cambered. There is a uniform taper through-



The Jetty and Coal Handling Plant at Wandsworth.

out the height of 20 ft., the average width being about 10 in. and the average breadth about 9 ft. Each oven takes a charge of 3¼ tons of coal and has a throughput of 7 tons per 24 hours.

The chambers are complete with waste heat boiler equipment so that steaming may be carried out during approximately the last two hours of the carbonizing period.

The coke is discharged from the chamber ovens into specially constructed coke buses, which are propelled by electric locomotives. The primary quenching of the coke takes place in the quenching towers, the final quenching being effected on the quenching wharf. In this way the moisture content of the coke is evenly distributed and maintained at a minimum.

The ovens are arranged in units of six, each unit being heated by gas obtained from an internal producer. The coke supplied to the producers consists of "scalpings" which is a grade of coke obtained by screening the whole of the coke produced in the works to 1½ in., and in which the greater part of the shale content is found.

No. 3 retort house, which adjoins the chamber oven plant, is normally a stand-by, but is being used for gas making during the re-setting of the second battery of ovens. In this house there are twelve beds of 10 horizontal retorts each.

Nos. 2 and 4 retort houses are of a similar character and contain also twelve beds of 10 horizontal large-section retorts, 24 in. by 18 in. by 23 ft. long. These horizontals are equipped for steaming, the steam inlet being drilled into the mouthpiece. The steam passes through a trap, so that only dry steam is used, while anti-dips are provided in order that the steam may pass the whole length of the retort. Here, again, steaming is carried out during the final two hours.

There are two independent water gas sets, each of 2¼ million cu.ft. per diem capacity. These are hand operated, with self-clinkering grates, and are complete with an annular boiler supplying low-pressure steam for the generators.

Coke Handling and Screening Plant.

The Wandsworth Company have recently installed the most up-to-date coke handling and screening plant, which was fully described and illustrated in the "JOURNAL" for April 11, 1934. This plant is capable of dealing with 30 tons per hour and delivers the final sizes of graded coke into five storage bunkers of the following capacities: Large screened coke (over 2 in.), 140 tons capacity; broken screened coke (1¼ in. to 2 in.), 133 tons; coke nuts (¾ in. to 1¼ in.), 80 tons; forge nuts (⅝ in. to ¾ in.), 58 tons; and breeze (0 in. to ⅝ in.), 58 tons. The bunkers, which are of reinforced concrete lined with tiles, are provided with 15 outlets—eight for road vehicles and seven for bagging. The Company are able to utilize all their coke breeze in the boiler house, thus enabling them to produce very cheap steam power.

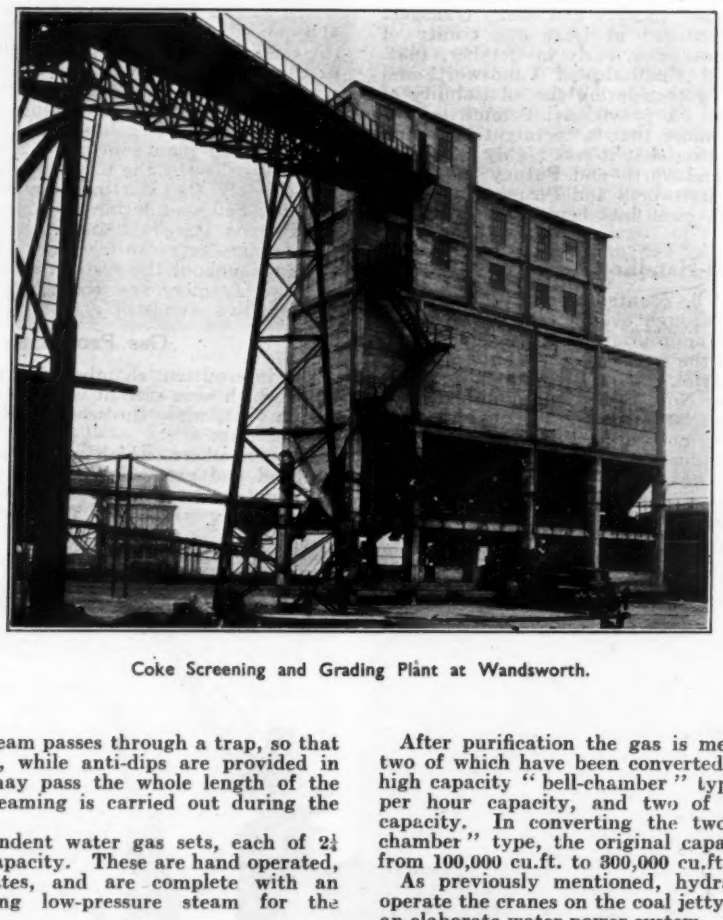
Vacuum Control Room.

A particularly interesting feature of the Wandsworth Works is the vacuum control room, which provides centralized control of retort house conditions. Samples of gas from each retort house stream are passed through small purifier boxes containing about 12 in. of oxide and separately tested and recorded on appropriate instruments. In addition to a recorder on each stream, there is a further check on the clean gas stream to and from the benzole plant and holder.

In the vacuum control room the Company have also recently fitted a small air meter to admit a measured quantity of air into the gas stream to assist in the revivification of the oxide in the purifiers.

In the exhauster house, in addition to the usual type of exhausting plant, is a single-stage steam turbine machine of 260 H.P. This works at 100 lbs. per sq.in. pressure at 3,250 r.p.m. normal exhauster speed.

The electrical power house is equipped with four sets of triple expansion steam engine driven generators, while a turbo generator of 600 H.P. is in process of installation. Further plant in this house includes two steam and one electric driven high-pressure boosters for pumping gas in bulk to other of the Company's works—Mitcham, Kingston, Epsom, and the Worcester Park holder station.



Coke Screening and Grading Plant at Wandsworth.

After purification the gas is measured by four meters, two of which have been converted from "drum" type to high capacity "bell-chamber" type, each of 300,000 cu.ft. per hour capacity, and two of 100,000 cu.ft. per hour capacity. In converting the two meters to the "bell-chamber" type, the original capacity has been increased from 100,000 cu.ft. to 300,000 cu.ft.

As previously mentioned, hydraulic power is used to operate the cranes on the coal jetty, and the Company have an elaborate water power system. Water from the Thames and from wells is pumped into two 60,000-gallon overhead concentric tanks, that from the river being previously passed through elliptical filters of 60,000 gallons per hour capacity. This filtration plant was described in detail in the "JOURNAL" for Feb. 20 last and consists of passing the water under pressure through a bed of graded sand.

From the water towers the water passes by gravity to storage tanks above the hydraulic power house, whence steam driven pumps, working at some 750 lbs. per sq.in. pressure, raise the heavy piston which in turn provides the pressure necessary for the cranes. There are three of these pumps—two in operation and one stand-by.

Boiler Plant.

From the foregoing it will have been appreciated that a very large amount of steam is required for the various

works purposes, for the provision of which there is an up-to-date boiler house containing three water tube boilers with a total output of 93,000 lbs. of steam per hour. These are equipped with chain grates, fed, as previously stated, with coke breeze, which is raised by bucket elevators to overhead hoppers. These boilers work at 180 lbs. per sq.in. pressure, and are additional to the three Lancashire boilers, which yield 12,000 lbs. of steam per hour.

The clinker, ash, and coke withdrawn from the producers of the carbonizing plant are treated in a magnetic ash separating plant. This consists of a feeding hopper, elevator, and revolving screen. Under the revolving screen are hoppers and chutes through which the graded material passes to the magnetic drum separators. Separation of the incombustible and combustible materials is effected by the attraction of the ash, &c., to the magnetic drums.

In addition to the usual washing, condensing, and purification system, the works are complete with benzole extraction plant, which is arranged to recover 3,000 gallons of " once-run " benzole per day, by absorption in gas oil in a static washer, from the mixed coal and carburetted water gas, and at the same time to remove naphthalene. The members of the Institution also had the opportunity of inspecting the well-equipped fitting shops which are attached to the works.

The total gas storage capacity of the Wandsworth Works is 4,710,000 cu.ft., while the annual make is in the region of 6,000 millions.

The Kent Tour

Friday was devoted to the Kent Tour, in the course of which the members had the opportunity of visiting both the Isle of Thanet Gas Light and Coke Company at Margate and the Canterbury Gas and Water Company. The two works visited are described below, while other details of the tour will be found on later pages.

AT MARGATE

The Isle of Thanet Gas Light and Coke Company obtained its first Act of Parliament in 1824, when statutory powers were granted " to provide gas to Margate, Ramsgate, Broadstairs, and places adjacent." The right to supply the last-named town was not exercised and a private Company now exists having that authority. Works were established at Margate and Ramsgate by the Isle of Thanet Gas Company, gas being supplied to each town until 1877, when the Ramsgate Corporation obtained Parliamentary powers to acquire that portion of the Company's Undertaking within their prescribed area; this led to a severance of the single property into two equal parts, leaving only Margate and District as the Company's sphere of operation. It is not without interest to note that, at the time of the separation, the Company's make for the two towns was about 118 million cu.ft., dropping to 55 million (for Margate only) the first full year thereafter, whereas, comparatively, in 1934 the corrected make of gas was approximately 530 million cu.ft.

The Works are situated right in the heart of the town, occupying an area of only three acres, separated by Addington Street, but a further 7¼ acres is scheduled for manufacture and storage at St. Peter's-in-Thanet.

The price of gas to ordinary consumers is remarkably low—7d. per therm, at a declared calorific value of 460 B.Th.U. gross per cu.ft. August generally comprises the month of maximum output, but during Christmastide, heavy daily outputs are recorded, nearly equivalent to the maximum day's output during the height of the season. The three-hours cooking load on Sunday mornings in August represents 33% of the total day's output.

Carbonizing Plant.

Woodall-Duckham continuous vertical retorts are alone used for coal carbonization. No. 1 installation comprises twenty retorts (in silica) 53 in. by 10 in. at top, and 25 ft. long, capable of carbonizing 5·7 tons of coal per retort per day, all complete with the usual equipment. An auxiliary gas producer is attached to this plant to augment the production of steam by its waste-heat boiler. Ammoniacal liquor is distilled, and the resultant ammonia is cracked in these retorts, the effluent passing into the sewer in the ordinary way.

No. 2 installation (about to be reconditioned) has eight retorts (in silica) each 103 in. by 10 in. at top, by 25 ft. 5 in. long, constructed to carbonize 10 tons of coal per retort per day. They are without regenerators, but with double coal feeds, and complete with the usual auxiliary plant.

Steaming facilities are provided for both installations, exhaust steam being utilized for this, also for the producers.

Carburetted Water Gas.

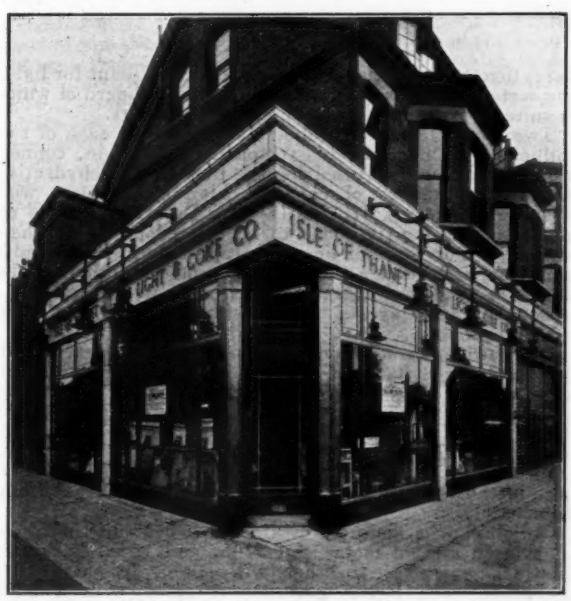
This plant is of Humphreys & Glasgow type, one million cu.ft. nominal daily capacity, and specially fitted with Connersville Blower and Centriflovane dust arresters, due to the close proximity to residential, and other, property. The carburetted water gas relief holder is of 50,000 cu.ft. capacity in steel tank, from which the crude gas passes through a Connersville meter, of 35,000 cu.ft. per hour nominal capacity to the coal gas condensers.

The requisite coal is brought by sea to Margate Harbour, unloaded by Priestman crane and grab into six-ton trailers, and hauled to the Works (about half-a-mile distant) by Fordson tractors.

Coal and Coke Handling.

Coals are passed through breakers, and delivered into either of two stores; they are raised by bucket elevators (1) to continuous rubber belt conveyors with tippers discharging into store, or (2) into a feeding hopper for elevation to bunkers over No. 1 bench, or (3) to gravity bucket elevator and tipping tray conveyor to hoppers over No. 2 bench, all operated by steam and gas engines. Coal is removed from the stores by 24-in. Zimmer conveyors under the floors which are fed through openings in the trench covers.

Coke is conveyed to the carburetted water gas plant via the gravity bucket elevator and tipping tray conveyor into a pushplate conveyor feeding the storage hopper adjoining the generator. Coke is discharged into skips, mechanically elevated and tipped into coke hoppers over the benches for producer feeding, any excess being conveyed, to be elevated



Exterior view of the Isle of Thanet Gas Light and Coke Company's recently completed Showrooms in the Westbrook District of Margate.

to the screening plant, by a balanced skip hoist operated by vertical steam engine with automatic reversing gear.

Special means have been adopted in this plant to avoid any noise or dissemination of coke dust. The elevated coke is discharged into a feeding hopper with breeches chute, and passes either over a jigger or direct into ungraded bunkers. The screens are of wire mesh, with ½-in., 1½-in., and 2½-in. square openings; the residue passing into the large screened compartment. The bunkers have double sets of outlet chutes fitted with static screens to eliminate breeze on loading. The bunkers are of mild steel, protected with concrete lining, faced with "Ironite," and carried by two 6-ft. deep built girders supported by steel stanchions on grillages and reinforced concrete foundations. A loading platform of 3-in thick timber is provided, and Pooley's weighing machines are in operation.

Manufacturing Plant.

This is effected by two sets of three towers of Clapham's "Eclipse" water-cooled condensers, with 24-in. connections, each set having a nominal capacity of two million cu.ft. per day. They are fed with softened water, which passes warmed to the boilers. The exhauster house accommodates duplicate sets of Donkin's exhausters, of 65,000 and 100,000 cu.ft. capacity, each with 18-in. and 24-in. connections. The messroom, fitted with baths, drying-room, &c., is overhead. Duplicate Keith-Blackman high-pressure compressing sets with a National gas engine and 4-in. high-pressure Mannesmann mains are housed here, together with the electrical generating plant for lighting certain portions of the Works, the switchboard of which is suitably provided for charging accumulators.

Two Holmes washer scrubbers are installed, each of two million cu.ft. nominal daily capacity with 24-in. connection, one of which is used for the purpose of dehydrating the gas by means of calcium chloride, complete with evaporator, &c. A Whessoe Electro Detarrer, for the removal of tar fog, is about to be erected adjoining these washers. For tar and liquor storage a large rectangular tank, partially under the purifiers, and two others under the coke yard, together with a circular well (formerly a gasholder tank) gives a total combined capacity of about 400,000 gallons.

The purifier installation consists of four boxes each 40 ft. by 20 ft. by 6 ft. deep, with 24-in. Pickering valve and connections. There are four covers to each box handled by runway suspended from the roof, oxide being raised by hoist and skips and discharged to the revivifying floor underneath through chutes and subsequently disintegrated and aerated by mechanical means. Two catch-boxes are also installed which may be operated either in sequence or alternately.

Adjoining the main offices are the 60,000 cu.ft. per hour Parkinson station meter and 24-in. and 18-in. Parkinson station governors, together with 10-in. by-pass safety governor. The larger governor is fitted with a novel water-loading device.

No. 1 gasholder is spirally-guided with four lifts and a capacity of 500,000 cu.ft. having special guiding arrangements to suit the tank. No. 2 has five lifts, guide-framed, with a capacity of 840,000 cu.ft.

A 50,000 cu.ft. per hour boosting set against a pressure of 12 in. is installed should necessity arise, to keep the heavier holder fully inflated.

Offices.

The general offices, including boardroom, Engineer's offices, and Collectors' Department, comprise one block at the corner of Addington Street with which throughout all parts of the Works intercommunication by telephone exists.

The sulphate of ammonia plant is not now in use, the liquor being dealt with as described under the caption "carbonizing plant." The Tar Dehydration Plant is also now disused, as crude tar is collected by the South-Eastern Tar Distillers, Ltd. The general and oil stores, fitters', and carpenters' shops and smithy constitute one block. Attention in general is given to district appliances in a two-storey building, 65 ft. long by 25 ft. wide. A portion of its upper floor is utilized for meter-testing purposes.

The boiler house contains two Lancashire boilers, with forced draught, consuming coke breeze. Adjoining the boiler house is the pump house accommodating the water, tar, and liquor pumps. The necessary Works water is obtained from a well situated adjoining the Works, the suction pipes from which are connected to Evans steam pumps in duplicate. All the water used on the Works for generation of steam, as well as to the condensers, is softened by means of a Kennicott lime-soda plant, and thereafter by being passed through a "Permutit" base-exchange softener.

The spacious and well laid out interior of Margate's new Gas Showrooms.

At the Works entrance are the Works Superintendent's and District Superintendent's offices, together with the weighbridge office, connected with the twenty-ton Pooley's weighbridge. Overhead is the Works laboratory, very fully equipped, with the official calorimeter, coal and tar testing section, and other necessary features connected with the routine and research work regularly undertaken.

Distribution.

There are approximately 55 miles of low-pressure gas mains laid throughout the district, fed by 24-in. and 18-in. main outlets from the Works; no mains of less than 4-in. bore are laid. The governor pressure at the Works is maintained steadily at 40/10ths, except during a few hours each morning. The consumers at present number close on 11,500, over 6,000 being supplied through prepayment meters; cooking by gas is practically universal, while some heating appliances are installed in almost every house. Cooking and heating appliances on hire are considerable and hire-purchase accounts for a further large number. Consumers' burners are maintained on very advantageous terms.

The public lamps to the extent of nearly 2,000 are almost entirely lighted by gas, all on low-pressure. Sugg's upright "Littleton" lamps of 1,000 and 500 nominal candle-power are erected along the front, and similar-sized suspended "Littleton" lamps are installed in High Street

—a rather narrow thoroughfare—while three-light clusters and twin burner lamps are mainly adopted elsewhere. Every gas lamp in the area is automatically operated, and the weekly winding and setting of these together with the cleaning and general maintenance is carried out by the Company. The district is divided into ten distinct sections, each with its own responsible maintenance attendant, whose duties in each case comprise the above work, thus creating healthy and beneficial competition.

Showrooms.

Three showrooms are installed on the district, one each in Cliftonville, Central (Dane Road), and Westbrook. The Cliftonville showrooms occupy a corner site, are very commodious, and have splendid window frontage and two floors. The Dane showrooms are the sales headquarters being close to the Works and, having been originally a school, are very large and roomy, making for excellent display and administrative purposes. A demonstration room has been equipped and fitted for cookery lectures, &c., complete with kitchen. The Westbrook showrooms also occupy a corner site, and the existence of a suitable basement enabled its conversion into a district workshop, where fitter and mate (with stores) are always in attendance.

Each of these showrooms is efficiently fitted up with live hot water demonstration sets, modern types of cooking and heating appliances, lighting sets, with very effective external and internal illumination by means of Sugg's lamps. Over each window in dark blue enamelled bronze lettering appear either the Company's name or captions indicating directions in which gas may be used.

AT CANTERBURY

The history of the Canterbury Gas Undertaking dates back to 1819, when it was established by Mr. John Gostling as a private enterprise on the present site in Castle Street. The Canterbury Gas Light and Coke Company was incorporated on May 15, 1822, but this Act was later repealed by the Canterbury Gas and Water Act of 1866.

During the early years of the Company's existence gas was charged for by the number of hours the burners were lighted during the year; an argand burner, for example, could be used from dusk until 9 p.m. for £3 10s. per annum. The compulsory early retirement was obviated in 1837, for the Company introduced gas meters and charged 16s. 8d. per 1,000 cu.ft.—*i.e.*, 3s. 7¾d. per therm. Since those early days the Company have by continued industry gone from strength to strength. The goodwill of the consumer has in particular received special attention and, to-day, the amount of gas sold annually by the Company is in the region of 180 million cu.ft. Over 7,700 consumers in Canterbury and district are served by the Company and of this number 4,500 use gas for cooking. The gas supplied has a calorific value of 460 B.Th.U. per cu.ft. and costs (subject to liberal discounts) 10d. a therm in the city and 10·8d. a therm outside the city.

The manufacturing side of the Undertaking has certainly not suffered as a result of the attention given to the consumer. Under the able control of Mr. R. Vevers Scott, the Company has made continued progress towards greater efficiency and during the past two years considerable reconstructions of the purifying plant have been carried out. This work comprised the installation of a vertical tube water cooled condenser, a Livesey washer, a rotary ammonia washer, rotary benzole and naphthalene extractor, and benzole plant.

The carbonizing plant consists of eighteen beds of 10 ft. stop-end retorts with eight retorts to each bed. The retorts are discharged by hand but charged by machine. The hot coke from the retorts is removed on a de Brouwer horizontal conveyor and thence by an inclined conveyor to the coke yard.

Storage is provided by two holders. The larger of these has three lifts, the outer and middle being column guided while the inner is a "flying" spirally-guided lift. This holder replaces a small one of 114,000 cu.ft. capacity. The second gasholder is at present grounded for repairs and modernization.

Reverting to the sales side, the showrooms, which were opened as recently as January of this year, have always in stock an excellent number of up-to-date appliances.

The Battersea Power Station

On Thursday afternoon, as an alternative to the Wandsworth visit, a number of members inspected the super generating station of the London Power Company, Ltd., at Battersea.

The London Power Company, Ltd., is the successor to the London Electricity Joint Committee (1920), Ltd., which was promoted by ten London supply companies for the purpose of formulating and executing schemes for the more economical generation of electrical energy.

The complete design adopted for Battersea aims at a total capacity of between 400,000 and 500,000 kilowatts. In the present buildings, however, only about one-half of that capacity is provided for, though some portions, such as the land, river works, circulating water conduits, railway sidings, and coal-handling equipment are sufficient—wholly or in part—for the completed station.

The area of the site is about fifteen acres, with a river front of about 677 ft. and jetty of reinforced concrete 426 ft. by 36 ft., allowing colliers of 2,000 tons to be berthed alongside. Between the jetty and the river wall is a barge berth 50 ft. wide, while between the river wall and the north front of the buildings is a sunken concrete coal store capable of holding 75,000 tons.

The main buildings measure some 480 ft. in length by 270 ft. wide and comprise switch house, turbine house, and boiler house. At each end of the present boiler house rise the well-known reinforced concrete chimneys, which, standing on a massive steel tower cased in brickwork, reach a total height of 337 ft. 6 in. above ground level and have an internal diameter tapering from 28 ft. to 22 ft. These are the tallest chimneys in London.

Two grab cranes which travel along the jetty take coal from the boats and discharge it through hoppers on to two belt conveyors running the length of the jetty. It is then transferred to another pair of conveyors which cross the barge berth to a control tower wherein are housed the weighing machines. From here the coal may be conveyed via the junction tower to the boiler house bunkers or to a conveyor running alongside the store, from which it can be recovered by means of a grab crane running on a transporter bridge and sent by conveyor to the bunkers or loaded into railway wagons for transit to the other generating stations of the Company. Suitably housed wagon tipplers permit of the reception of coal by rail and transmission to the junction tower. The jetty cranes can handle 240 tons per hour, so that a 2,000-ton collier can be cleared in one tide by each. The capacity of the belt conveyors varies from 240 to 400 tons per hour, and the speed from 360 to 400 ft. per minute.

The boiler house is designed for a row of nine boilers, of which six have been installed—of Babcock & Wilcox design rated at a normal evaporation of 250,000 lbs. per hour of steam at 625 lbs. per sq. in. and 875°-900° F. The maximum continuous evaporation is 312,000 lbs. per hour, with a peak load capacity of 330,000 lbs. Extending over the boilers are the economizers, air heaters, grit collectors, and forced draught fans. Each boiler is provided with control board and indicating panel.

The turbines are 3-cylinder machines, with the low-pressure cylinder of divided flow, duplex exhaust pattern. The high-pressure cylinder casing is of cast steel and contains 19 impulse stages. The main generators are flexibly coupled to the low-pressure turbine shafts and to the house service generators which are in turn coupled to the exciter groups, making an overall length for each set of 102 ft. The main generators are rated at 64,000 kilowatts and 80,000 kilovolt amperes at 11,000 volts, 3-phase, 50 periods. Transformers step up to 66,000 volts for distance transmission.

Social Events and Visits

The Reception and Dance.

This was held, as usual, on the Tuesday evening at the Park Lane Hotel, and was attended by a record number of guests. By time-honoured custom the District Association of which the Institution President is a member had the honour of presenting a bouquet to the President's wife; and to Mrs. E. L. Nicholas, of Guildford, on this occasion fell the pleasing duty of making the presentation.

MRS. VALON BENNETT.

Jack Palmer and his band supplied the music for dancing, which continued from 9 p.m. until 2 a.m., and there was an entertainment by Gordon Marsh and his Silver Jubilee Cabaret. During the evening, too, the golf prizes won at the Spring Meeting of the S.B.G.I. Golf Circle on June 3 were presented by Mrs. Valon Bennett. The President's Prize, a silver salver, was won by Mr. C. E. Holt, and the "Thornton Victory Cup" by Mr. J. B. Clay. For Bogey Foursomes, prizes had been presented by Mr. H. E. Bennet, and these were won by Mr. L. J. L. Walker and Mr. W. E. Dean.

If to this brief paragraph regarding a most successful function we add a criticism, let it not be thought that any single guest failed to enjoy the evening to the fullest extent. Our comment, prompted by hearing all grades of opinion, is that the popularity of the function has caused it long since to outgrow the really comfortable limit of the accommodation, and movement on the dance floor and circulation among one's friends becomes increasingly difficult year by year. We understand that nearly 1,000 attended.

Second Overseas Delegates Reunion Dinner.

To commemorate the visit to Canada and the United States in 1933 and the Second International Gas Conference in Switzerland last year, there was a Reunion Dinner at the Park Lane Hotel on Wednesday evening. There were over 60 present, including Herr Fritz Escher, Hon. Vice-President of the International Union, who had interrupted his attendance at the Annual Meeting of the Association Technique in Marseilles especially to hurry to London for this function.

The Toast of "The King" having been honoured, the Chairman, Mr. C. Valon Bennett, proposed "Our Friends of the International Gas Union and the Overseas Gas Associations," which toast was drunk simultaneously in New York, Toronto, Zurich, and Marseilles. Thereafter Mr. Alexander read telegrams of good wishes from Mrs. Tarratt, Major Alexander Forward, Mr. Clifford Paige, and Mr. Arthur Hewitt, and added a few words of special welcome to Herr Escher. Later in the evening, Herr Escher, in proposing the toast of Mr. Harold Copp, First President of the Union, made the happy remark that, whereas in many countries he has many friends, here in England he feels we are all his friends.

The toast of "Absent Members" was honoured at 10 p.m., and then the Toast of "The Chairman" was proposed by Mr. F. P. Tarratt.

It was with great regret that all those present at the dinner and their many other friends learnt that Mrs. Tarratt, half way on the journey to London, had been obliged by sudden indisposition to return to Newcastle.

At the President's Works.

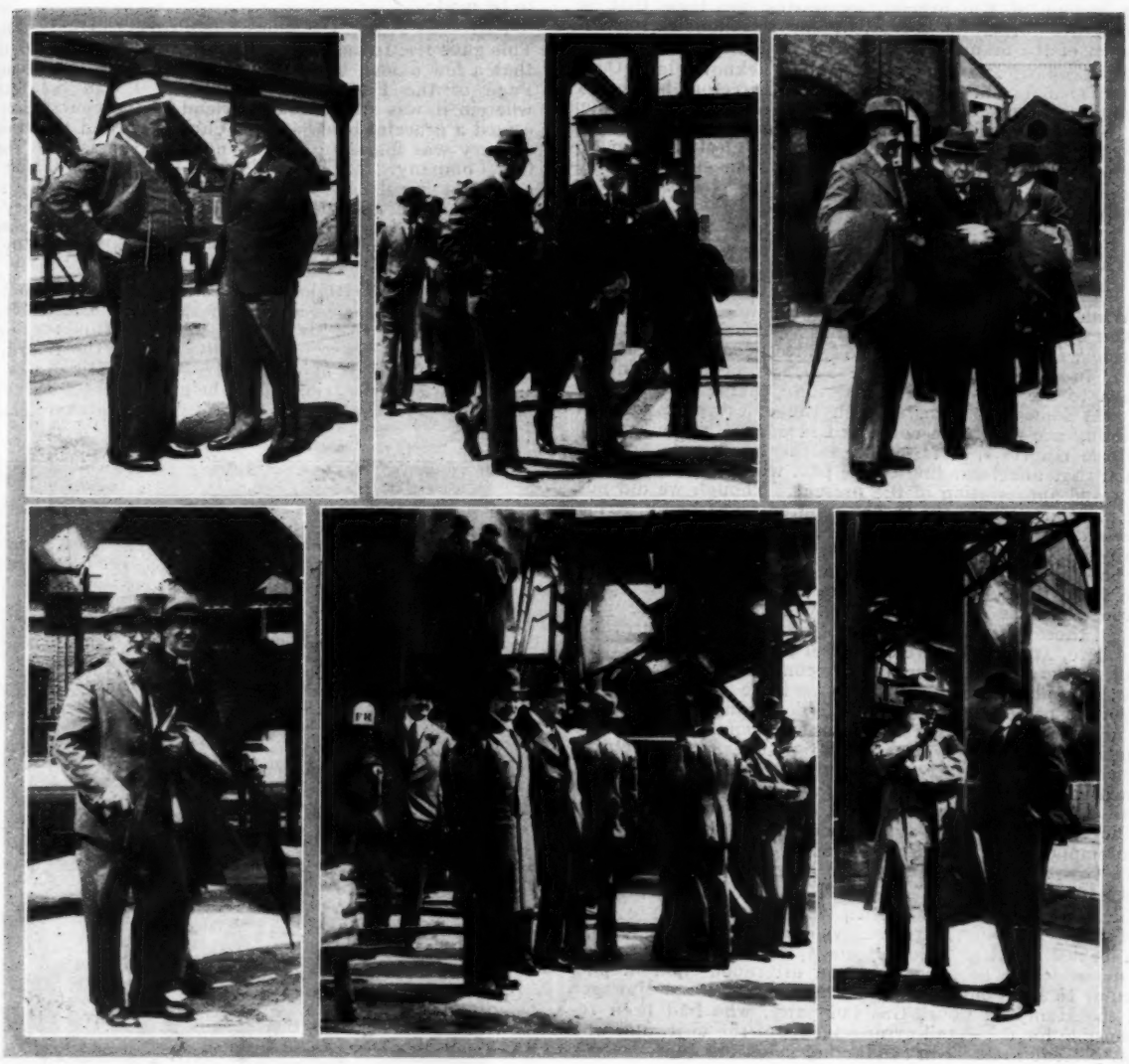
By special train from Victoria on Wednesday, June 5, over 330 members travelled to Rochester to inspect the Rochester Works of the Rochester, Chatham, and Gillingham Gas Company, or to visit the historical Cathedral. Lunch was served *en route*, and the afternoon's programme was strictly adhered to.

Tea was taken in the Chatham Town Hall on the invitation of the Directors of the Rochester, Chatham, and Gillingham Gas Company. A vote of thanks to the Directors was proposed by Col. W. Moncrieff Carr. They knew that when they came to see the President's works they were going to see something good, and they had not been disappointed. He congratulated Mr. C. Valon Bennett on the wonderful state of the plant at his works. Although they took him by surprise in visiting the Distribution Department, they found the same orderly state existing there. In conclusion, he thanked the Corporation of Chatham for the use of their fine Hall. The vote was carried with acclamation.

Responding on behalf of the Directors of the Company, Mr. R. W. Foot, O.B.E., M.C., said it was a proud day in the annals of the Rochester, Chatham, and Gillingham Gas Company. It was also a proud day when Mr. Valon Bennett was elected President of The Institution of Gas Engineers. He congratulated Mr. Bennett on the way in which he had carried out his duties in that capacity and went on to thank the members for their appreciation of their hospitality as shown by the splendid attendance.

Sir Leonard Pearce, C.B.E., with the President at the Battersea Power Station.

Conversation Pieces at Rochester Gas-Works



The Wandsworth Works.

On the Thursday afternoon a party of nearly 300, with Colonel W. M. Carr in command and Mr. E. Fletcher as his adjutant, drove in motor omnibuses to the Wandsworth Works of the Wandsworth and District Gas Company, where the most admirable arrangements for their reception had been made by the Chief Engineer and General Manager, Mr. C. M. Croft.

Guides were provided in abundance and, conspicuously but neatly attired in white overalls, they knew their job and did it exceedingly well both as regards guiding, explaining, and keeping their parties together. In the large area of the Works there was ample room for inspection without confusion, and when later the guests met at the offices for tea it was unanimously agreed that the visit could be classed among the most pleasurable of its kind—a verdict which was reinforced by the comfort in which an excellent tea was taken.

Colonel Carr expressed, on behalf of the Institution, and of all those present, thanks for the great entertainment which had been provided by the Directors of the Wandsworth Company and so splendidly organized by Mr. Croft and his staff. In replying, Mr. Croft expressed the great regret of the Chairman, Mr. Frank H. Jones, at having been unable to be present to welcome the guests. This was the first visit the Institution had ever paid to Wandsworth, and they were more than gratified at the numbers who had come to see them in spite of the counter-attraction of their friend the enemy a little further down the River.

Battersea Power Station.

It was a very large party which took advantage of the invitation of the London Power Company, Ltd., to visit their wonderful Battersea Power Station, and no pains had been spared by the Company to make the visit as informative and as interesting as possible. After a tour of the Works, tea was served in the canteen, where the few speeches made were noteworthy for their appositeness, brevity, and sincerity. Sir Francis Fladgate, M.V.O., J.P., the Chairman, voiced the deep pleasure it gave him to see the great Gas Industry, which he ought to detest but admired, come to visit a young brother. After mentioning the lighting of the Lyceum by gas in 1803, Sir Francis referred to the early work of his friend Hollinshead in 1863, and to the noteworthy milestone passed when the Savoy Theatre was entirely lighted by electricity in 1871. He expressed the hope that the very proper curiosity and the intellectual appetite of their guests had been satisfied, and closed by paying a tribute to the work of his Engineer-in-Chief, Sir Leonard Pearce—not least in achieving their riddance from the bugbears of dirt and effluent.

Mr. Valon Bennett thanked the London Power Company

for their hospitalitly and a most interesting visit. After all, he said, they were all engineers and all in the one service of the public. There was no reason why electricians and gas men should not try to learn from their brothers. He voiced the visitors' thanks to the Staff for all their trouble, and he congratulated Sir Leonard Pearce upon the honour of Knighthood, expressing the hope that he would live for many years to enjoy this honour and the esteem of the many who knew him by sight and repute.

Sir Leonard Pearce, C.B.E., D.Sc., acknowledged these tributes, and said that not only his Directors but every member of his staff felt highly honoured at the selection of their Station for such an important visit. He echoed Mr. Bennett's remark that both gas and electricity undertakings were striving towards the common end of attaining a purer atmosphere and the better service of their consumers.

The Beauties of Hampton Court.

While technical visits of importance were being undertaken by members of the Institution, a no less attractive outing was arranged on Thursday afternoon for the ladies, who, to the number of some 120, proceeded by motor coach to the ever-popular Hampton Court Palace and its no less famous gardens. Even the oldest parts of this building are not to be compared in age with many other historic edifices, but nevertheless there is ample here to assist that understanding of the past which is so necessary to a due appreciation of the present. Though we did not see, but only heard about, the reputed ghost of Catherine Howard, we lived for a couple of hours with the spirits of many who, even if their examples are not in every respect to be commended, yet must remain of undying memory. We stood in the deserted kitchens, and tried mentally to reconstruct the scenes of activity that must have prevailed there when a banquet was in course of preparation; and here, at any rate, we could feel sorry for our ancestral cooks, who had no temperature-controlled gas oven, in which to place the boars' heads and the venison pasties. Then we passed through the galleries, pausing frequently to admire objects of particular interest pointed out by the guides among the paintings and tapestries. The pictures which have been justly named the Beauties of Hampton Court received their tribute of admiration, but side by side with this admiration was the soothing evidence that beauty is not the prerogative of any period. Later we stood in contemplation of the Great Vine—years older than our own Great Industry, but, like it, seemingly endowed with perpetual youth.

Tea in the Tilt Yard Garden was punctuated by a well-deserved expression of thanks, voiced by Mr. A. C. Hovey, on behalf of Mrs. Valon Bennett, to all who had been responsible for so pleasurable an afternoon—and in particular to Mr. Conrad T. Price, the Engineer and Manager of the Hampton Court Gas Company, who had been responsible for the detail arrangements of the visit, and who was present to assist in conducting us on our tour.

A Day in Kent.

Sussex having been explored from several angles in immediately preceding years, Kent was decided upon for the tour on the present occasion, and not one out of the 250 or so who travelled down by the special train on Friday morning could have regretted the decision. The programme comprised, in visits to Margate and Canterbury, an attractive blend of ancient with modern; for while Margate, right down to its Publicity Magazine, is modern in the very newest sense of the word, Canterbury, by its noble Cathedral and historic associations, takes us far back into the past.

On arrival at Margate, a large proportion of the visitors betook themselves to the gas-works, where a short time was spent, under the guidance of Mr. J. M. Campbell, Engineer and General Manager of the Isle of Thanet Gas Light and Coke Company, Mr. Prater, Works Superintendent, and Messrs. Banner, Wells, and Colpus. The Secretary and Accountant of the Company, Mr. A. J. Stickels, was, of course, present to assist in welcoming the visitors, while, in the handsome showrooms nearby, they were in charge of Mr. Bishop, the Sales Manager, and Mr. Kennett, who is Chairman of the Southern District (Kent Area) Salesmen's Circle. At about 7d. per therm, the Company supply cheap gas; and the showroom inspected—one of several—provided eloquent testimony to up-to-date service methods. Just those little things most likely to catch the eye of the housewife were found prominently displayed; and in this respect special mention must be made of an artistic range of illuminating glassware—not so often as it should be a feature of gas showrooms. The big demonstration hall should bring down upon the Company the blessings of many thousands of sojourners in the apartment houses and boarding establishments of the town; for here, alas, good cooks are generally not born, but have to be made.

There was also in the showroom a pretty little bird bath. This gave rise to one or two remarks which seemed to show that a few among the visitors had forgotten the Woman's Page of the February issue of the "GAS SALESMAN," wherein it was stated that a friend of the contributor received a graceful bird-bath for Christmas, and that this on enquiry was found to have come from the Isle of Thanet Gas Company. "I gather," said the writer, "that the coke-dust is collected after screening, and bound in some way to make all sorts of garden ornaments. They are turned out in a rich creamy colour. In summer a roaring trade is done; motorists passing by are attracted by the sight to pull up and buy."

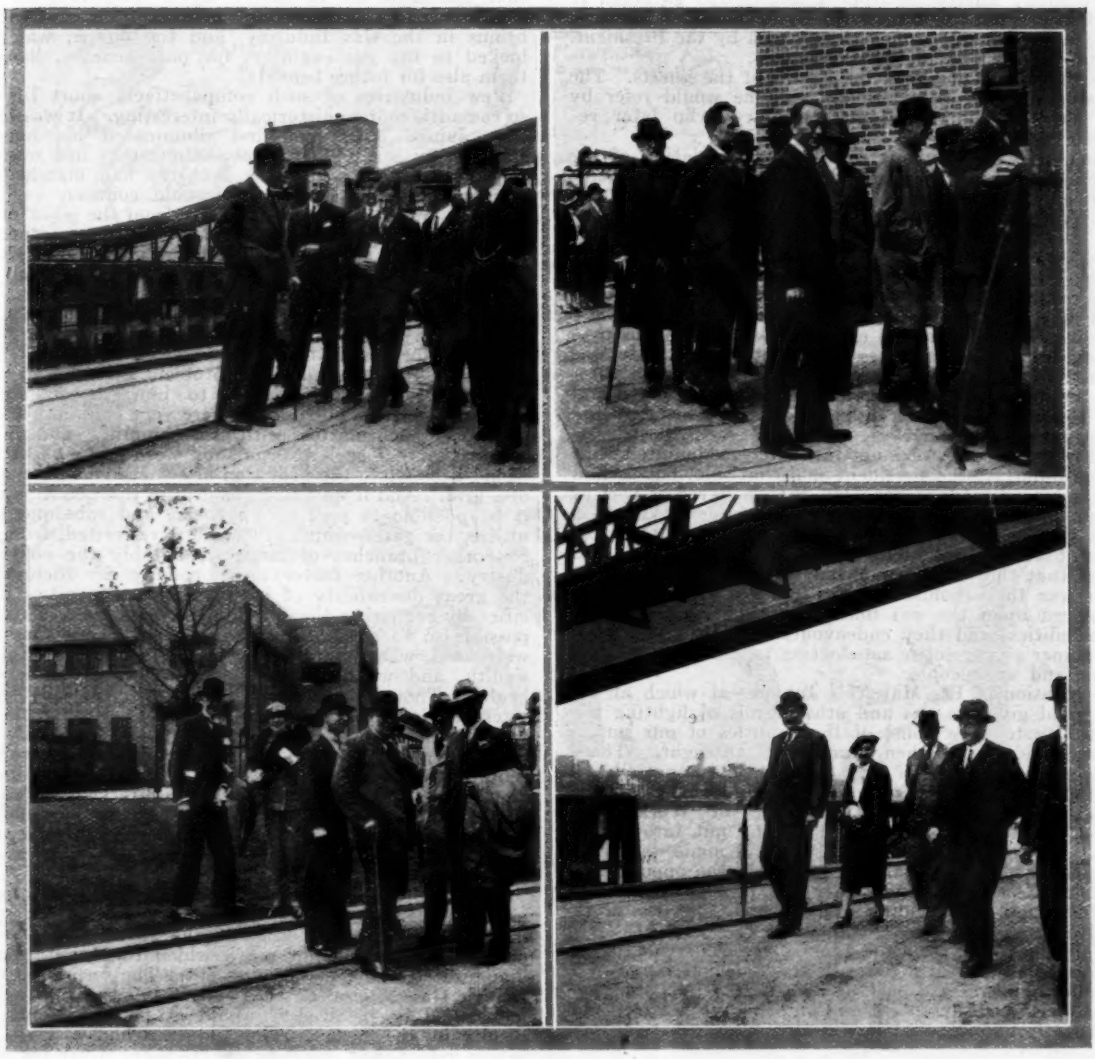
In the Queen's Highcliffe Hotel, Cliftonville, about 300 sat down to luncheon, as the guests of the Isle of Thanet Gas Company—with Mr. W. B. Reeve, a Director, in the chair. He was supported by colleagues on the Board, but unfortunately the Chairman, Mr. Walter Hills, was prevented by indisposition from being present. A pretty episode was the handing of beautiful bouquets on behalf of the Institution to Mrs. Reeve, to the Mayoress, and to Mrs. Valon Bennett; the presentations being made respectively by Miss Butler, Miss M. Miller, and Miss Langley.

View down the Great Boiler House at Battersea.

The Mayor of Margate, Alderman F. L. Pettman, cordially welcomed the Institution. "I have," he said, "had experience of the Gas Industry of this town, inasmuch as I have lived here all my life; and I have seen it grow and grow again. In Margate we have had excellent service from the Gas Company. We are proud to know that a Man of Kent has risen to the important position of President of your Institution." [Applause.] The President voiced the indebtedness of the visitors to the Corporation for the many facilities afforded for the occasion. Mr. Valon Bennett proceeded: "I must make some reference to our very dear friend, Mr. Campbell. It has been my good fortune to know him for more than thirty years, and every one of those years has endeared him more and more to me. He has had much to do with to-day's proceedings, and on behalf of the Institution I wish to tender him hearty thanks." ["Hear, hear."]

Col. W. Moncrieff Carr, President-Elect of the Institution, expressed the earnest wish of all present for the speedy restoration to health of the Chairman of the Company, and added that in the visit to the works and the showrooms the members had not been disappointed. They knew now why Margate was able to sell cheap gas. On behalf of the visitors, he thanked the Isle of Thanet Gas Company for their generous hospitality, and Mr. Campbell

Gas Engineers at the Battersea Power Station



and his staff for all they had done. Mr. C. C. Maughan, a Director, responding, declared that the Company were not afraid of any rivals. They continued to reduce the price of gas and to pay good dividends. A hearty vote of thanks to the Chairman for presiding was accorded on the proposition of Mr. Stephen Lacey, Vice-President of the Institution.

By this time rain had given place to bright sunshine, and the motor coach drive to Canterbury—as far as possible by the coast road—was delightful. Of this part of the day's proceedings little need be said here; for who is there that does not know Canterbury and its Cathedral, whose rich associations were outlined to the visitors in a most interesting manner by Miss Babington, the valued Secretary to the Friends of Canterbury Cathedral? Some went to the magnificent nurseries of Messrs. George Mount & Sons; while others inspected the old Norman Castle Keep, dating back to 1090. This Keep has been recently renovated, having been bought back by the City Council from the Gas Company, who had used it as a coal store.

Tea was served in the County Hall, by invitation of the Board of the Canterbury Gas and Water Company, who were thanked by the President for their hospitality, and for all the arrangements they had made in connection with the visit to this wonderful and ancient city. He also thanked the Engineer, Mr. R. Vevers Scott, and his staff for their efforts, which had contributed greatly to the afternoon's success. The Chairman replied that it had been a great pleasure to them to do what they could.

Supper was served on the train coming back to town, but before leaving Canterbury Col. Carr said they would all like Mr. Valon Bennett to appreciate what a wonderful meeting the Institution had had under him as President. Unfortunately, Mrs. Valon Bennett had had to return home, but he asked the President to convey to her their very grateful thanks. The President replied that any success which might have attended his year of office was due to three things—the loyal support of the Council and members of the Institution, the great amount of work done by Mr. Alexander, and the help he had had from his wife.

The President's Luncheon

A company numbering approximately 180 gathered in the Ballroom at the Savoy Hotel on Tuesday, June 4, where they were entertained to luncheon by the President.

The loyal toast having been honoured,

The PRESIDENT proposed the health of the guests. The list being so long, the President said he would refer by name to only one—Sir Henry Maybury—who later responded to the toast.

Continuing, Mr. Bennett expressed appreciation of the facilities which had been provided by all the Institution's friends to visit their works and boroughs during the week, and he referred particularly to the London Power Company. To the man in the street it might appear peculiar for gas engineers to visit an electrical generating station. But in reality there was nothing extraordinary about it; they were all engineers, and, although the industries they served were in competition with each other, they were national industries, and gas engineers were not opposed to learning from their confrères on the other side. He was certain that any application from the Institution of Electrical Engineers would receive the same whole-hearted and warm response as was given to the gas engineers by the London Power Company.

To the guests who were not intimately acquainted with the Gas Industry, the President said that, glorious as had been its record in days gone by, they believed it was as nothing compared with that which was to come. The Gas Industry was essentially a fuel industry. They recognized, he said, that coal was the natural wealth of England, and claimed that the most economical way of employing that wealth was to carbonize it at a gas-works. Parliament had placed upon the gas undertakings many and large responsibilities, and they endeavoured to carry them out in a manner giving entire satisfaction to consumers, shareholders, and workpeople.

The occasion of His Majesty's Jubilee—at which all rejoiced—had given to gas and other forms of lighting the opportunity to show some of the beauties of our public buildings and parks when illuminated at night. There had been much praise of this floodlighting, especially in regard to that of the trees, flowers, and shrubs in St. James's Park. His Majesty's Office of Works had graciously permitted this lighting to be put into action again. For this permission, the President made respectful public acknowledgment; and he also took the opportunity to thank the Gas Light and Coke Company for their public-spirited action in providing and carrying out the work free of cost.

Coupling with the toast the name of Sir Henry Maybury, the President recalled that Sir Henry had had charge of a gas undertaking in the past, though he had left the profession for a more lucrative one in the Civil Service, and subsequently had left that for the still more lucrative position of a consulting engineer!

Brigadier-General Sir HENRY MAYBURY, G.B.E., K.C.M.G., C.B., J.P., M.Inst.C.E. (Immediate Past President, Institution of Civil Engineers), on behalf of the guests, tendered the warmest thanks. There were many present who were his colleagues, he was glad to say, in the Industry many years ago; indeed, he believed he was one of the original members of The Institution of Gas Engineers. [Applause.] It was a peculiar pleasure to him to be present to support the President, whom he had known all his working life, and Sir Henry said he could remember at least two generations of Mr. Bennett's forebears in the Institution. The guests were proud of the part which the Institution and the Gas Industry were playing in the welfare and economic procedure of the country, and were quite sure that, so long as the profession attracted highly-skilled and trained minds and brains, the Industry had nothing to fear, but would go from strength to strength.

Beneficial to the Coal Industry.

Sir RICHARD REDMAYNE, K.C.B., M.Sc., M.Inst.C.E., M.I.Mech.E. (President, Institution of Civil Engineers), proposing "The Institution of Gas Engineers," said he had the greatest possible pleasure in proposing the toast, for four very important reasons. The first was that the Gas Industry was, after iron smelting, perhaps the most beneficial to the coal industry. Secondly, the Gas Industry had done, was still doing, and would continue to do great service to mankind. Thirdly, gas was a smokeless fuel, and few industries contributed more to the amenities of life in that particular. It rendered our towns smokeless—or it would do if it were more universally used—and it afforded a most wonderful light. It was a curious fact that one could see a gas light through a thick fog better than one could see an electric light. Fourthly, the great Institution of Gas Engineers comprised some of the best brains in the Gas Industry, and the public, which had looked to the gas engineers for past benefits, looked to them also for future benefits.

Few industries of such comparatively short life were so romantic and so historically interesting. It was in 1792 that James Watt had first illuminated his house in Redruth by gas. What great changes they had seen since then! But always the Gas Industry had marched with the times, and he believed it would continue to do so. But one must not regard it merely from the point of view of providing means of illumination, heating, and cooking; it had been the means also of bringing into being a number of ancillary and most important industries, which were dependent almost entirely upon it.

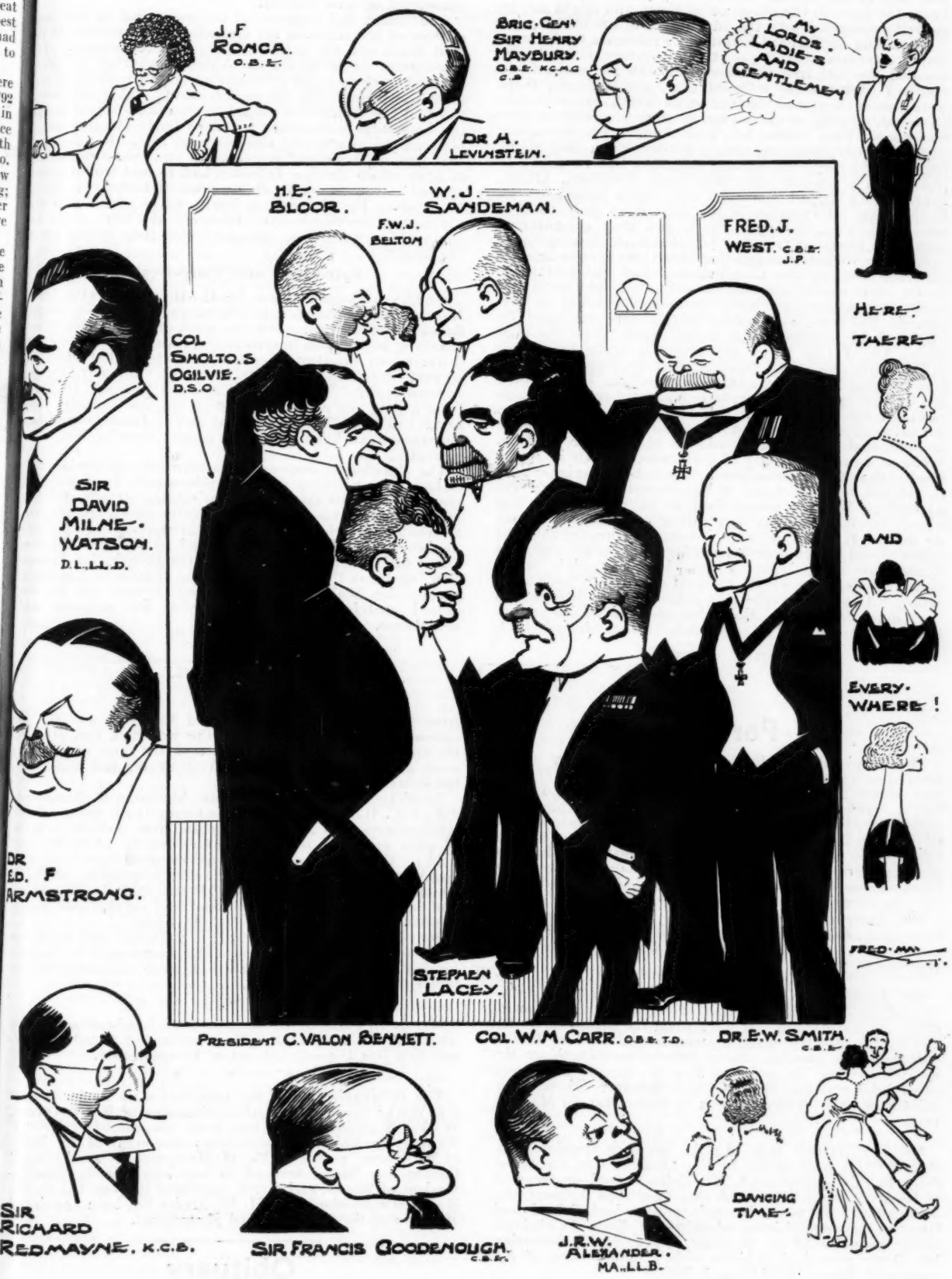
In a reference to problems which would confront the Industry in the future, Sir Richard asked what were the prospects for long-distance transmission of gas under high pressure. Having studied the problem abroad, and especially in Germany, it seemed to him, as an absolute amateur, that the possibilities were very considerable. He mentioned such matters with great humility, and in great trepidation. If such transmission were given effect to, it would necessitate the provision of something in the nature of a grid. And if we had a gas grid in this country, would it be possible to pick up *en route*, and subsequently to utilize, the gases, which otherwise were wasted, from various other branches of industry, notably the coking industry? Another factor mentioned by Sir Richard was the great desirability of improving the amenities of our cities by rendering the atmosphere smokeless. If it were possible so to arrange matters that only smokeless fuels were used, what an enormous saving would be effected in wealth, and what benefits in regard to cleanliness and health. Though one hesitated to suggest Government intervention in industry, he felt that Government could help if it were to lay down some regulation whereby cities having a population exceeding a certain number would be required within a specified time to consume nothing but smokeless fuel. He would suggest intervention only to that extent. Incidentally, the greater consumption of gas, and of coke and semi-coke, as the result of such action would benefit enormously a much distressed industry—the coal mining industry.

He had been privileged to look through the Annual Report of this great and lively Institution, and to scan a number of Papers presented to the meeting, and he was amazed by the splendid work which the Institution had inaugurated and was carrying out. The formation of the British Gas Federation, too, represented a fine achievement, and he believed it would attain very remarkable results in the future. The Industry had a very great future indeed, and it was to the members of the Institution that they looked for the development of that future. Sir Richard coupled with his toast the name of Colonel Carr.

Second to None.

Colonel W. MONCRIEFF CARR, O.B.E., T.D. (President-Elect), responded, and expressed gratitude for Sir Richard's kindly references to the work of the Institution and of the Industry. Gas engineers, he said, did not believe that their industry was second in importance to any; they believed it to be even more important than the smelting of iron, and even more important in its ultimate effect upon the nation as a whole than the raising and working of coal, because they believed that, but for the Gas Industry, coal could not render the service to this nation that it must render for many generations to come. Commenting upon the importance of attracting highly-trained men to the Industry, Colonel Carr emphasized that not only did they need engineers who were capable technicians in the production of gas from coal, but they needed, even more, engineers who were experienced fuel technologists, who were able to apply their brains to the better utilization of the gas in the service of industry and in the homes of the public as a whole. It was hard to attract these men, and he felt that the Industry must make up its mind that it would pay more and that it was going to secure the service of the best brains obtainable in this country. It must be prepared to pay very much more, not only to technicians on the production side, but also in order to secure the best brains in connection with utilization. Many manufacturers, as, for instance, those in Sheffield, where gas was being used on an extensive scale in the manufacture of steel, were finding that there were enormous advantages, and economic ad-

Among those Present" at the President's Luncheon and Reception



As seen by Fred May.

vantages, in the utilization of a clean, high-grade fuel. With these facts before them, gas engineers had no fear of the future; and in the future they would not suffer from the modesty from which they had suffered in the past, in not having called out from the housetops the value of their gas, and in not having sought every possible occasion to bring the facts to the attention of those who might not be so well acquainted with the advantages of the use of gas.

Discussing Sir Richard Redmayne's reference to the long-distance transmission of gas at high pressure, Colonel Carr recalled the activities in connection with the gas grid in South Yorkshire. He believed that, within limits, there were possibilities; but, on the other hand, gas engineers were not anxious to go so far as their electrical friends had gone. They rather felt that those in the electricity supply industry were carrying a burden which they might find rather heavy, and the gas engineers had no desire to place such a burden upon their own shoulders. [Hear, hear.] They hoped sincerely that there would be no Government intervention in the way of an endeavour to place such a burden upon them, and they sympathized with their electrical friends. [Applause and laughter.]

With Sir Richard's suggestion that there should be close relations between the Gas Industry and the coking industry there would be general accord; anything that would result in producing gas more economically would be welcomed. But there was another factor. One was painfully aware of the procedure now being begun under the Coal Mines Act of 1930 in an endeavour to make the public utilities, gas and electricity, pay more for their coal. The Gas Industry was most anxious and willing to pay more for its coal—provided everybody else paid more for their coal. It did not wish that there should be discrimination as between one user and another. It was extremely anxious that the miner should be in a better position. While it feared the hand of Government when it apprehended that that hand might be applied in discrimination, it did not fear the hand of Government if applied impartially. If more money had to be provided for the miner, the Gas Industry was willing and anxious to pay its share. It would welcome a definite assurance that the miner would derive benefit from increased price, and that if the price of coal were advanced to the public utility undertakings, the coalowner should not be in a position to supply his own gas-works (the coke-ovens) with coal at a very much lower price than that charged to gas undertakings generally. The gas undertakings feared that, unless they were given protection, their development might be somewhat hindered. They did not fear that their development could ever be stopped; they believed that within a very few generations the use of soft coal in the domestic grate and in industry would be terminated, as it should be at the earliest possible moment, in the interests of every inhabitant of these islands.

One would feel happier if, on every one of the committees of investigation set up under the provisions of the Coal Mines Act, the public utilities were represented. The committees would be set up to decide whether the prices charged were fair and economic or whether the coal supplied was suitable for the requirements, and it was essential that the committees should be composed of people with the knowledge and ability to assess fairly the position as between the buyers and the sellers of coal. It was hoped that that matter would be adjusted, and that any increase of price which the Gas Industry had to find would not be applied to the reduction of the price of household coal or to reducing the already too low price at which coal was supplied to the coke-ovens. However, the fears of the gas engineers were small as compared with their confidence in the future.

Spiritually and Corporeally.

Sir DAVID MILNE-WATSON, LL.D., D.L., M.A. (President, National Gas Council, and Chairman of Council, British Gas Federation), proposing the toast of the President and thanking him for his hospitality, recalled also that he had delivered an excellent Presidential Address that morning, so that he had ministered to his guests spiritually as well as corporeally. They were all grateful to him. He came from a long line of notable men in the Gas Industry, and never had the office of President of The Institution of Gas Engineers been filled with more dignity than by Mr. Valon Bennett.

The PRESIDENT, responding, assured the gathering that it had been a source of great pleasure to have occupied the Presidential Chair of the Institution. It afforded him great pleasure also to welcome so many of his friends, and he would remember the occasion throughout his life. His forebears would have been proud indeed if they could have heard the Chairman of Council of the British Gas Federation, who was Chairman also of the Rochester Company, propose his health in such felicitous terms; and he was indeed grateful for the manner of its proposal and acceptance.

Personal

The friends of Captain and Mrs. W. J. LIBERTY will be grieved to know that Mrs. Liberty, who was one of those who joined the Institution "Kentish Tour" on Friday, had a serious attack of heart failure on returning that night. Her life was despaired of, but she has made a slight rally. She is not yet, however, out of danger. Captain Liberty has had to cancel all engagements, including the visit to Germany with the International Commission of Illumination on which he represents the Gas Industry.

* * *

Mr. ARTHUR WHITTINGHAM, J.P., has been appointed Chairman of the Whitchurch (Salop) Gas Company, Ltd., to fill the vacancy caused by the death of Major J. G. Harrison.

* * *

Mr. ARCHIBALD KELLOCK, the very popular Hon. Secretary of the North British Association, was the recipient of many congratulations last week upon the honour accorded him by His Majesty in the presentation of a Silver Jubilee commemoration medal. By an interesting coincidence Mr. Kellock received his medal on May 28—the eve of his own silver jubilee as Gas Engineer and Manager—his first appointment as such having been to Pontefract on May 30, 1910.

* * *

Mr. J. E. DOLBY, B.A., A.C.A., has been appointed Assistant Chief Accountant to the Sheffield Gas Company. Prior to this appointment, Mr. Dolby served on the staff of Messrs. Cooper Brothers & Co., Chartered Accountants, of London. He was educated at Stamford School and later was an exhibitioner of Selwyn College, Cambridge, where he obtained an Honours Degree in Mathematics. Mr. Dolby served his articles with a London firm of Accountants, Messrs. Wilkinson & Mellor.

* * *

There was an interesting gathering at the Chesterton Gas-Works of the Newcastle-under-Lyme Gas Department on Friday, May 30, when Mr. C. J. LOVERIDGE, who retired from the position of Engineer and Manager, was the recipient of a presentation from the workmen and staff of the Gas Undertaking. The gift took the form of a handsome grandfather clock, with Westminster and Whittington chimes, suitably inscribed.

In making the presentation, Mr. Alderman R. Beresford, J.P., C.C. (Chairman of the Gas Committee), spoke of the sterling work that Mr. Loveridge had done during his term of office and paid tribute to the esteem in which he was held by the Council, staff, and workmen of the Chesterton Gas-Works, and the admiration and respect by all with whom he had come in contact. He said that Mr. Loveridge had been an excellent official and had carried out many improvements and additions at the works.

Mr. Loveridge, in thanking the workmen and staff for their magnificent gift, spoke of the deep regret he had at leaving them, and wished them a most successful future under the new management.

* * *

Mr. A. E. PEEL, of Stockton-on-Tees, has been appointed Assistant Engineer to the Morecambe and Heysham Corporation Gas Department out of 85 applicants.

* * *

The re-organization of the technical staff at the Belfast Gas-Works consequent on the resignation of Mr. T. Owens, Works Superintendent, has been completed. Mr. J. HYSLOP, the Chief Assistant, takes over many of the duties of Mr. Owens' position. Mr. H. HARRISON, B.Sc., Assistant Carbonizing Superintendent, is appointed Junior Superintendent of Works, and Mr. A. CAMPBELL is promoted to Mr. Harrison's position. Mr. H. W. STEELE has been appointed Manager of the Ormeau Road Showrooms.

Obituary

We regret to report the death, at the age of 72, of Mr. E. BISHOP, Vice-Chairman of the Swindon United Gas Company. He had been a Director of the Company since 1928.

South African Lighting Association, Ltd.

Annual General Meeting

The Forty-Sixth Ordinary General Meeting of the shareholders of the South African Lighting Association, Ltd., was held in the Association's London Offices, 48, Copthall Avenue, E.C. 2, on Wednesday, June 5, 1935—Mr. WILLIAM CASH, J.P., F.C.A. (Chairman of Directors), presiding.

The SECRETARY (Mr. William Cash, Junr., M.A., F.C.A.) read the notice convening the meeting, together with the minutes of the last Ordinary General Meeting, held on May 30, 1934, which were confirmed and signed. He also read the Auditor's report on the Accounts and Balance-Sheet.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN, in moving the adoption of the Directors' Report and Statement of Accounts for the twelve months ended Dec. 31, 1934, said he did not think there was very much upon which he need enlarge beyond what was in the Report. At their last meeting he had said that the Directors were not looking for substantial improvement so far as dividend was concerned, meaning that their progress would be relatively small. But the Accounts before them that day had certain very satisfactory features.

In the profit and loss account it would be seen that the profit for the year amounted to £5,960, which compared with £4,607 the previous year and £4,075 in 1932. The profit for the year 1934, therefore, showed an increase over the previous year's figure of £1,353. Whereas in the year 1933 they drew on their carry-forward to the extent of £101 in order to pay a dividend of 3%, he was glad to be able to inform them that in the year 1934 they were not only paying 3½% but were adding £308 10s. 8d. to the carry-forward. It would also be seen that they had made an additional allocation of £500 to the renewal fund over and above their usual allocation. In the year 1933 the renewal fund was increased by £350 and in 1934 by £1,085, so that it now stood at £3,561, as compared with £2,476 at Dec. 31, 1933. The fund was mainly intended for the renewal of retorts, and some little time must elapse before any renewals would become chargeable to the accounts.

Sales of Gas.

The next paragraph in the Report dealt with the sales of gas. A year ago he had told them that the consumption at Port Elizabeth was stationary, while that at Grahamstown showed only a small increase. This year there had been an increase of 5½% at Port Elizabeth and 15½% at Grahamstown. They would, he knew, ask why there had been this large increase in the latter town; it was due to their supplying gas to the Mental Hospital, which was taking a substantial quantity. However, no matter where the gas went, it was satisfactory to know that they had this large increase at their smaller station.

The Report went on to tell them that there had been some recovery in the economic position in South Africa; and they had sent out, both for the hire-purchase and direct sales, a substantial number of up-to-date gas cookers, fires, and water heaters. At Port Elizabeth they were able to record a few additional consumers and at Grahamstown relatively quite a substantial increase—namely, 40—while a satisfactory feature was that, on analysis, there had been a substantial increase in the sales of gas to ordinary consumers, some increase to slot consumers, and an increase of 8% to industrial consumers. The total numbers of consumers at Port Elizabeth and Grahamstown were respectively 2,453 and 1,022. They had installed at Port Elizabeth 136 additional cooking stoves and at Grahamstown 73; while another 40 geysers had been installed at the former town. These results were attributable to a large extent to the new showrooms which were opened in Port Elizabeth on June 1, 1934, and in Grahamstown in April of the same year.

Their new Manager in South Africa, Mr. J. H. Goldsmith, had held a number of demonstrations which had been well attended, and considerable interest had been taken in what they had been able to show their consumers. Several of their demonstrations had been attended by hundreds of people, which he was sure had resulted in increased interest in gas for both cooking and heating. Another satisfactory feature was the increased average consumption per consumer at both towns—by over 1,000 cu.ft. of gas per annum in each case—a feature they would like to see repeated in this country.

They had done better as regards residuals by over £400, taking the total of both stations, while the profit on the sales of appliances was also up by £600. Coal had cost them rather more by reason of the greater quantity of gas made, while repairs to mains was also up by something over £300. Their new showrooms had, of course, involved additional expense to the extent of between £500 and £600. On the other hand, they had saved some £200 on salaries.

An Indication of Better Times.

The Chairman felt that they might be encouraged by the results of the year 1934 and by the fact that they were able to make some small increase in the dividend—as some indication of the fact that times were better in South Africa. They were hoping to get back to their old records.

In regard to their local representatives, Mr. Goldsmith had done well and had established excellent relations with the authorities. They had heard this from more than one source, which was confirmation of the opinion they had formed of him. The people seemed to like him and considered him the right sort of man to represent the Company very well on the spot. Mr. Goldsmith took over in November, 1933, so this was his first complete year. They had also sent out Mr. Haley as Works Manager at Grahamstown; he had come to them with excellent credentials from the Torpoint Coal and Gas Company, Ltd., Cornwall. Mr. Coulson had been moved from Grahamstown to take up the position of Assistant Manager at Port Elizabeth, while they would see from the Report that Mr. E. M. Sterley, who had acted as local Secretary at Port Elizabeth for twenty-seven years, had retired at the end of March last. For thirty-five years Mr. Sterley had been a most faithful and diligent servant of the Company, and he was sure they would agree that the Directors had done right in awarding him a pension. As a result of these various official changes, and allowing for Mr. Sterley's pension, they had been able to effect a small saving in salaries. Mr. Sterley would continue to reside in South Africa, so he would still be able to give them the advantage of his valuable advice. They owed Mr. Sterley a debt of gratitude for all he had done for the Association during his long period of service.

He had in previous years, continued the Chairman, made reference to their leakage figures. They were still higher than they would like, but Grahamstown had shown a small reduction. This was a matter which received the constant attention of their officers.

In the Balance-Sheet it would be seen that their investments remained the same, though their market value as compared with last year had increased by nearly £1,000 and stood at £2,801 more than in the books of the Association. Their general financial condition was shown in the Balance-Sheet, and he thought they were in a fairly strong position in this respect.

Scales of Charge.

There had been no alteration in the price of gas during the year, though they were allowing discounts to industrial consumers in Port Elizabeth, so that the over-all price had been 3½d. per 1,000 cu.ft. less. They had very carefully considered their basis of charge—as to whether they should adopt some form of two-part tariff or sliding scale. They had, however, a large number of small consumers, and to make such a method of charge effective they would have to start at a relatively high price. The effect of putting such a scale into effect might therefore be to lose a large number of these small consumers, and he felt that they might tend to lose more than they would gain. Moreover, the fact that they were obtaining an increased consumption per consumer rather encouraged them to hold their hand as regards putting any different method of charge into operation. It was much better to push the sales of gas appliances rather than make any sweeping reductions in the price of gas.

The Chairman then formally moved the resolution for the adoption of the Report and Accounts.

Mr. HENRY WOODALL, J.P., M.Inst.C.E., in seconding, referred to the very severe competition with which they were faced in South Africa. But the general prosperity of the Association was reflected in the improvement in their business, and they were in a very much more satisfactory position, and things were much brighter, than a year ago.

In response to the Chairman's invitation to shareholders to raise any points in connection with the Report and Accounts before them.

Mr. H. B. SMITH said that they had local assets to the extent of £10,000, and if this sum was in excess of requirements would they be able to redeem any of the 6½% debentures?

The CHAIRMAN, in reply, said that he did not think they could afford to part with this amount of cash and investments because it represented, in part, their renewal fund, which would have to be spent sooner or later. They could not redeem any of the debentures except by consent of the holders, who, he thought, would probably rather hold on to their 6½% for the time being. The debentures were redeemable in 1941.

The CHAIRMAN then put the resolution to the meeting, and it was carried unanimously.

Dividend.

The CHAIRMAN thereafter moved the payment of a dividend for the year at the rate of 3½%, less income-tax at 3s. 3½d. in the £, explaining that this rate of income-tax was arrived at

by agreement with the Inland Revenue Authorities in connection with Dominion income-tax recovered in this country.

Mr. T. N. G. JENNINGS seconded this resolution, which was unanimously agreed to.

Re-Election of Director and Auditor.

Mr. F. R. SMITH moved the re-election of Mr. William Cash, being the Director retiring by rotation, remarking that they could not have anyone with greater experience of this kind of work than Mr. Cash.

The resolution was seconded by Mr. W. ARNOTT and carried unanimously, Mr. CASH briefly acknowledging his re-election.

On the proposition of Mr. H. B. SMITH, seconded by Mr. ARNOTT, the Association's Auditor (Mr. Percival D. Griffiths, F.C.A.), was re-appointed at the same remuneration as previously—namely, 40 guineas.

Votes of Thanks.

The CHAIRMAN moved a hearty vote of thanks to the officers and staff of the Association in South Africa and London. Mr. Haley only reached Grahamstown in the spring of this year, though Mr. Goldsmith had now completed a year in South Africa, and he need not repeat what he had already said of him. This vote of thanks also included Mr. Sterley, who had just retired. These and the other officers and staff in South Africa had had a hard time. Competition was very keen, and they had done a great deal to push gas—and they had produced better results in the year 1934. They were entitled to a real vote of thanks—not one merely as a matter of form. In London Mr. Scott was very good in the way he corresponded every week with South Africa, while the Secretary and those who kept the accounts in London also watched their interests very closely and were all entitled to a vote of thanks.

Mr. H. B. SMITH, in seconding the vote, said that it was perfectly obvious that in an undertaking of this description, however able the Directors, the ultimate success of the concern depended very largely upon those on the spot.

Mr. F. R. SMITH, in proposing a vote of thanks to the Chairman and Directors, observed that things looked much more rosy for the future.

Mr. ARNOTT seconded the vote, which was carried unanimously.

The CHAIRMAN briefly acknowledged the vote on behalf of himself and his colleagues, and stated that the first quarter of the present year already showed an increase in the sales of gas—so he had every reason to think that they were now really doing better.

The meeting then terminated.

Malta and Mediterranean Gas Company, Ltd.

Annual Meeting

The Annual General Meeting of the stockholders of the Malta and Mediterranean Gas Company, Ltd., was held on Tuesday, June 4, 1935, in the London Offices of the Company, 5, Great Winchester Street, E.C. 2—Mr. A. M. PADDON, M.Inst.C.E. (Chairman of Directors), presiding.

The SECRETARY (Mr. G. Murray Burton) read the notice convening the meeting, together with the Auditors' report, and the Company's seal was affixed to the register of shareholders and duly signed. The Directors' Report and Statement of Accounts were taken as read.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN, in moving the adoption of the Report and Accounts, said that the accounts were rather better than they appeared at first sight. They would see that the deficit on the year's working was equivalent to £1,080. It would, however, be remembered that not quite two years ago they deliberately and as a matter of policy reduced the price of gas by 6d. per 1,000 cu.ft., which represented a sum of £2,000. So, had they maintained the *status ante quo*, they would have had a surplus of £900 on the year's working. This deficit was inevitable and was a direct consequence of the policy he had mentioned. They had to reduce the price of gas for several reasons, including that of Governmental relationships and other circumstances existing in Malta. They only partially felt the results of this reduction in the previous year; but this year they had the full effect of the reduction.

There had been a reduction in the amount of gas sold of 3%, which was symptomatic of the whole Gas Industry to-day, whether in this country or abroad; and so far as they had been able to ascertain it was largely due to the very much improved types of apparatus which were being put out in recent years—which performed for 20% less gas the services rendered by the older appliances. In the long run, however, this would be to the advantage of the Industry, though in the meantime it meant some truncation in the output of gas. Thus, by the sale of gas they had lost £1,319 on the previous year's figure. Rental of meters and stoves had brought in £142 less and residual products £331 less. Their reduction on the credit side was therefore £1,793.

There were, of course, some offsets on the other side of the account. The first group, including coal, oil, coke, purification, maintenance of works, salaries, and carbonizing wages, &c., showed a reduced expenditure of £413, while the next group, including rents, salaries and superannuation, general establishment charges, Directors' and Auditors' fees, &c., showed a saving of £91. So the balance of profit for the year, carried to the profit and loss account, appeared to be £1,302 less. That was, however, qualified by certain reductions in taxes, so that, applying the acid test of comparing the amount they took out of the account with the amount they brought in, it would be seen that there was a deficit of £1,080, which was entirely accounted for by the reduction in the price of gas by itself, without any other qualifying circumstances.

The Balance-Sheet.

The Balance-Sheet, continued the Chairman, showed a very happy state of affairs. Their investments amounted to £121,000, which was £4,208 more than the previous year. A little note would tell them the realizable value of these investments at the present time (£170,889). If they turned to the liabilities side of the Balance-Sheet they would see recorded the increment from their investments. The dividends from their investments, on the general, amortizement, and reserve accounts came to some £4,697 per annum. Their investments were available as capital which they had laid up in amortization of the Company's capital. If they looked at the other side of the account they would have every cause to congratulate themselves.

They were trading in Malta under good conditions. Two or three years ago there were strong hopes of developing the island as a health resort, but he was doubtful whether it could compete with the Côte d'Azure or the Balearic Islands. The Company had a stability of which he did not think they would be deprived, and taking that in conjunction with the financial condition which they had so painstakingly built up, he thought they might look forward with reasonable confidence to the Report they would be presenting in twelve months' time.

The CHAIRMAN then formally moved the adoption of the Directors' Report and Statement of Accounts, which was seconded by Mr. A. W. OKE.

Alderman F. W. CHURCH expressed appreciation of the Chairman's lucid statement. This was, he said, a wonderful little Company, with which he was proud to be connected; their investments balanced their capital. In conclusion, he enquired if the Undertaking had any form of concession in Malta.

The CHAIRMAN replied that they had a concession, which ran out in eighteen years' time. This was a question to which they were giving constant consideration as to whether they should move in the matter. To move prematurely in a matter of this kind would be dangerous, and he thought they would wait a few years longer until there was a greater use of electricity on the island.

The resolution for the adoption of the Report and Accounts was then put to the meeting by the CHAIRMAN and carried unanimously.

Dividends.

The CHAIRMAN thereafter moved:

> That final dividends at the full rates on the first and second preference stock and a dividend of 5% (free of income-tax) on the ordinary stock, making for the year (with the interim dividends paid in December last) a total distribution of 7% on the first preference stock; 7½% on the second preference stock; and 10% (free of income-tax) on the ordinary stock.

This was seconded by Mr. FRANK H. JONES, M.Inst.C.E., and unanimously agreed.

Re-Election of Director.

The CHAIRMAN, in moving the re-election of Brig.-General Goland V. Clarke, C.M.G., D.S.O., the Director retiring by rotation, remarked that his re-election would preserve an almost traditional relationship between the Company and his family. General Clarke had what he described as a "cosmopolitan knowledge of matters appertaining to the occidental hemisphere" which was very useful to their Company. He could assist them very much and always did so.

This was seconded by Mr. E. L. BURTON, F.S.A.A., and carried unanimously—General CLARKE briefly acknowledging his re-election.

Re-Appointment of Auditors.

On the proposition of Mr. F. R. SMITH, seconded by Alderman CHURCH, the Company's Auditors (Messrs. William Cash, F.C.A., and Hyde Clarke Burton, F.C.A.) were re-appointed for the ensuing year at a remuneration of forty guineas each.

Votes of Thanks.

The CHAIRMAN went on to move a hearty vote of thanks to the officers and staff of the Company both in London and Malta. As regards the latter, the fact that they were working

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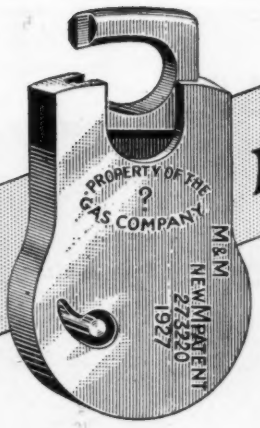

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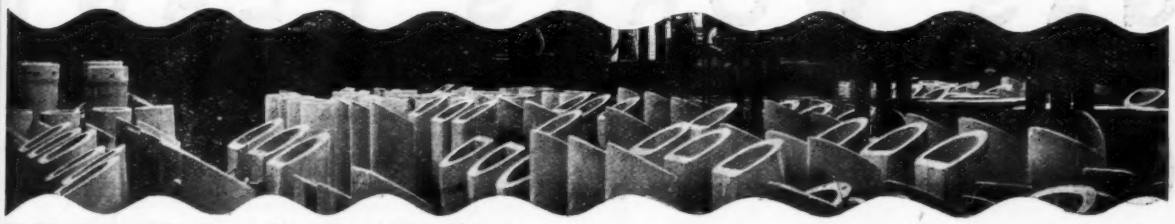

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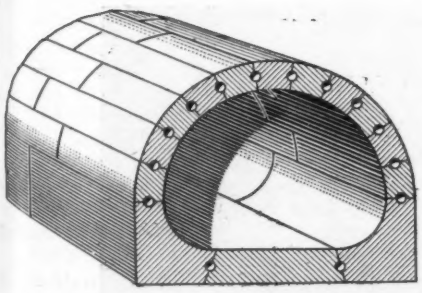

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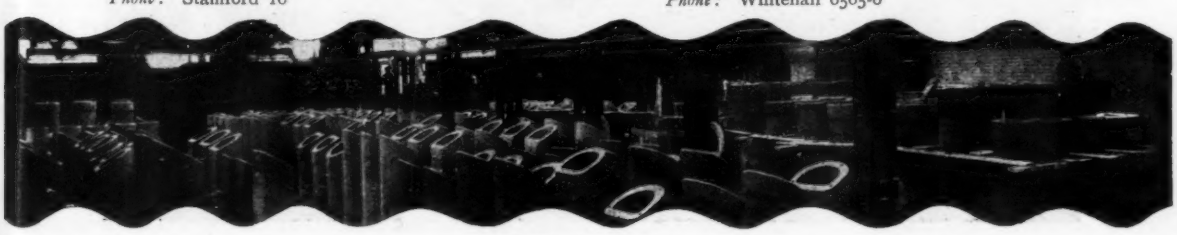

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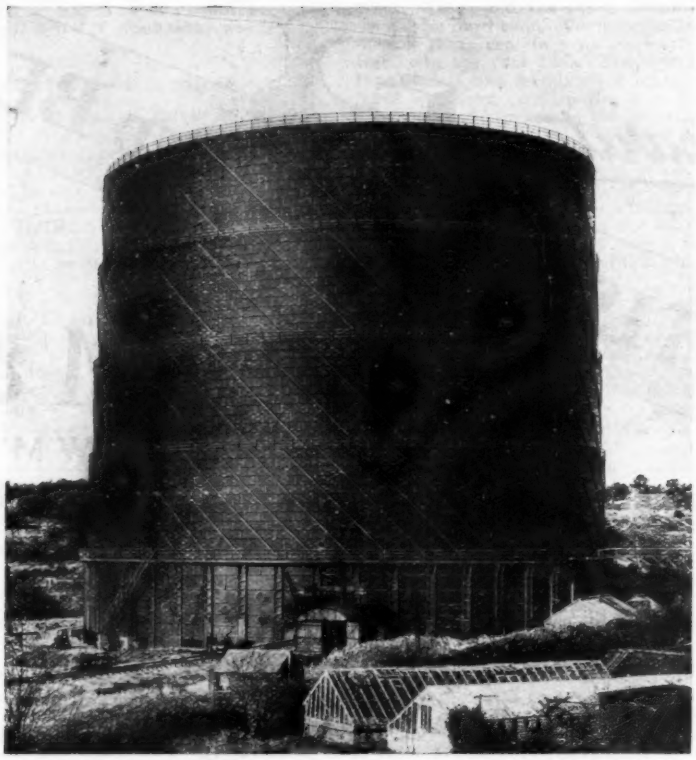

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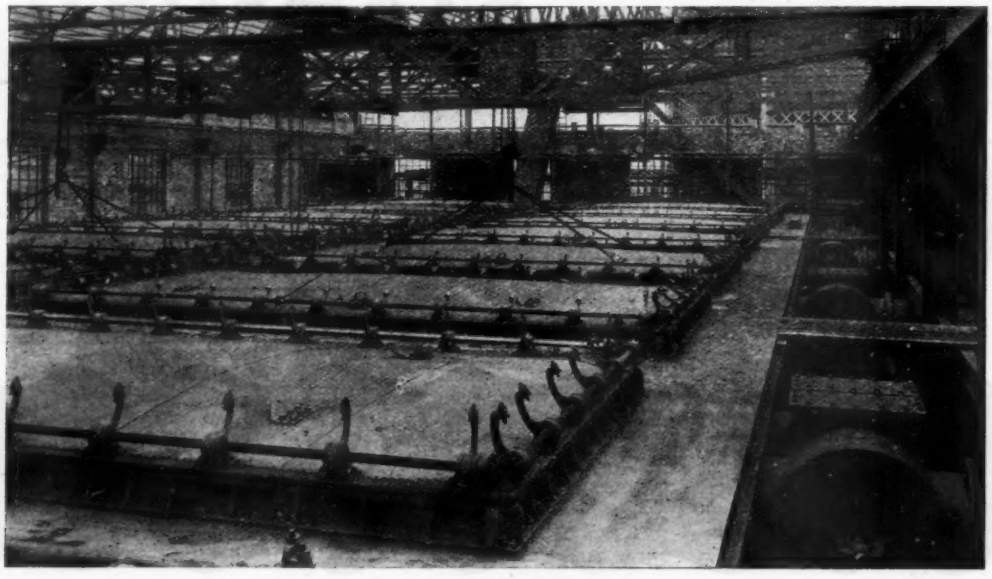

AT CAMBRIDGE

in Malta under strange conditions would tell them that it called for rather more than ordinary care and skill. Their relationship with their consumers was peculiar, as they had to deal with the Admiralty, the Army, and the Services generally. All that called for tact, care, and efficiency, and they would like to hear the shareholders' thanks for it. In Mr. Burton, their Secretary, they had an assiduous servant who was fully qualified in his profession, and he was assisted by an able staff in London.

Mr. F. ELIOT WILLIAMS said he would like to take the opportunity of seconding this vote of thanks. By the courtesy of the Board and the local officers he had been enabled to visit their works, showrooms, and district in Malta recently. He had been very impressed with the neatness and efficiency of the works. The district was a very difficult one, and he would imagine that further out the gas consumption must be very small. As regards their showrooms, he would offer one suggestion—namely, that they could with advantage be in a more prominent position. At the moment they were rather "round the corner." The Chairman had referred to Malta as a health resort; but he could hardly agree with him in this respect. He would most heartily second this vote of thanks to the staff because he did realize their difficulties and the extent to which the success of the Company was in the hands of the staff, working as they were away from this country.

The vote of thanks was heartily accorded, and Mr. G. M. BURTON briefly acknowledged it on behalf of the staff both in London and Malta.

The meeting was brought to a conclusion with a cordial vote of thanks to the Chairman and Directors, on the proposition of Alderman CHURCH, seconded by Mrs. C. PLATT, which was duly acknowledged by Mr. PADDON.

New Associates of the Institution

The following were among the elections made at the Institution meeting. A list of those elected to other classes of membership is given on p. 737.

Atkinson, Thomas Herbert, Distribution and Sales Superintendent, Brighouse Corporation Gas Department.

Brown, Donald Lambert, Assistant Works Manager, Brighton, Hove, and Worthing Gas Company.

Buckley, Eric Shackleton, Manager and Distribution Superintendent, The Camborne Gas Company, Ltd.

Butt, Francis Alan, Chief Chemist, Torquay and Paignton Gas Company.

Cheetham, Hugh Southworth, Engineer, Humphreys & Glasgow, Ltd., London.

Coltman, Eric Alfred Cyril, Depôt Inspector, Tottenham and District Gas Company, London.

Francis, Stanley Sydney, Project Engineer, The Woodall-Duckham Companies, London.

Frost, Walter Henry, Manager, Oundle Gas Light and Coke Company (1910), Ltd.

Gibbons, James Henry, Chief Technical Assistant to Sales Superintendent, The Croydon Gas Company.

Gould, Arthur Kempton, Technical Assistant and Chemist, Shipley Urban District Council Gas Department.

Halliwell, Frederick Britton, Junior Technical Assistant, Rotherham Corporation Gas Department.

Henly, Leonard James Douglas, Staff Officer, South Metropolitan Gas Company, London.

Hutchinson, Raymond, Assistant Engineer and Manager, Worksop Gas Company.

Jones, Samuel Tomlinson, Technical Assistant, Colwyn Bay Urban District Council Gas Department.

Latham, Roy Worthington, B.Sc., Assistant Engineer, The Croydon Gas Company.

Leckie, James Napier, Engineer and Manager, Windermere Gas and Water Department.

MacLaren, Robert Allen, Engineer and Manager, The Newton-on-Ayr Gas Company, Ltd.

Millner, Frederick, Distribution and Lighting Superintendent, The Scarborough Gas Company.

Milne, Harold Samuel, B.Sc., Technical Assistant, Greenock Corporation Gas Department.

Moys, Harold, B.Sc., Engineering Assistant, The Croydon Gas Company.

Siddons, Victor Joseph John, Chief Mechanic, The Barnsley Gas Company.

Sperryn, George Neville, Chairman and Joint Managing Director, Sperryn & Co., Birmingham.

Stapp, Alfred George, Technical Sales Supervisor, The Gas Light and Coke Company, London.

Ward, Edward Richard, Chief Works Chemist, South Suburban Gas Company, London.

Williams, Norman Henry, M.Sc., Research Assistant, Joint Research Committee of The Institution of Gas Engineers and Leeds University.

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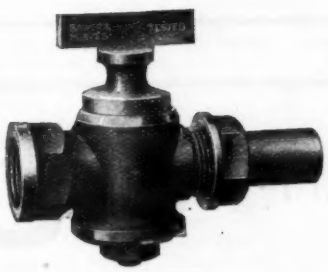

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MANCHESTER, 10
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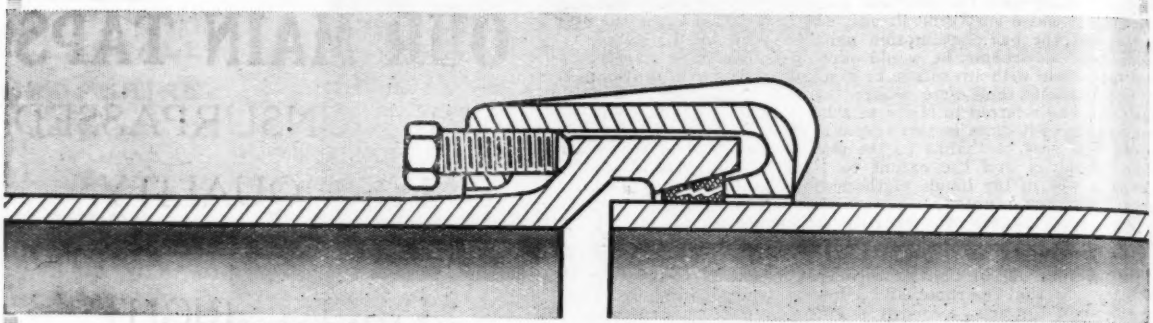
GRAMS: SAWER MANCHESTER

The STANTON MECHANICAL LEAD JOINT



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For over a century engineers have felt the need for a lead pipe-joint which can be made quickly and efficiently, without special tools, by an unskilled workman. This need is now supplied by the Stanton Mechanical Lead Joint.

This Joint employs the same material as the tried and tested lead joint, yet eliminates the slow and laborious operations of lead melting, running and caulking. All the workman has to do is to slip into position two half-collars and a wedge-shaped lead joint-ring, and to tighten four cast iron set screws. The ring is then mechanically and positively compressed into a taper recess, from which it cannot be dislodged. The joint is very quickly made under the most adverse conditions—under water if necessary.

The Stanton Mechanical Lead Joint permits "drawing" of the spigot and a greater angular distortion than is possible with a caulked joint. Where heavy vibration necessitates a high degree of flexibility, the Stanton-Wilson Joint should be used.

THE STANTON IRONWORKS COMPANY LIMITED, Near NOTTINGHAM

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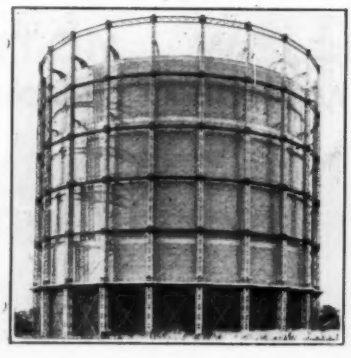
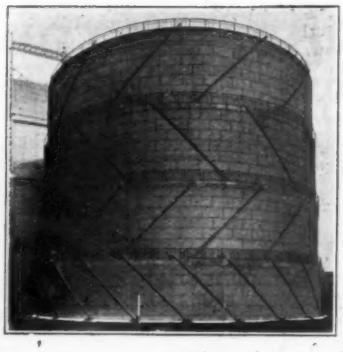
STEEL TANKS





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Gas Markets and Manufactures

Stock Market Report

(For Stock and Share List, see later page)

Many influences were at work to vary the trend of business last week. The political happenings in France, the end of the Account, the Derby, and the approaching Whitsun holiday were all disturbing factors, and it was only in a few favoured groups that any show of much activity lasted up to the close. Prices, generally, however, kept steady and interest was maintained by such features as the £4,000,000 Manchester loan, which was an instant success, and the Chancellor's statement of the Government's intention to guarantee funds to develop London's transport facilities. The more generous terms of the former led to some dullness in British Government stocks, though once the issue has been absorbed an early recovery is anticipated.

The volume of business in the Gas Market showed no signs of falling off and in most cases prices were well maintained. There were a few strong features, including a sharp rise of 10½ points in European to 125, a gain of 7 in Imperial Continental to 312, thus more than wiping out the previous week's set-back, and a rise of 3 to 107½ in South Suburban 4% preference. Apart from the seasonal *ex* dividend markings in fixed-interest stocks, only four issues were reduced in value, the heaviest fall being that of Liverpool ordinary on the local Exchange by 4 points to 138.

The Swansea Gas Light Company's 6½% debenture stock, £200,000 of which is outstanding, is due for redemption on June 30, 1937, and the Directors are giving the holders thereof the option to convert into a new issue of 3½% stock, redeemable in twenty years, in lieu of repayment on the due date. Holders of the Company's ordinary and loan capital have the right to subscribe for the new stock at £98% up to an amount equivalent to the nominal value of the 6½% debenture stock repaid. The present price of the latter on the London Exchange is now 98-103 *ex* dividend.

The Directors of the Lowestoft Water and Gas Company are issuing for sale by tender £35,000 4% preference stock at a minimum of par. The accounts show that during each of the last three years both the sales of gas and the revenue from water have materially increased, and that after allowing for the payment of loan interest the preference dividend, including the present issue, is covered nearly four times. The issue is being made through Messrs. A. & W. Richards, 37, Walbrook, E.C. 4, and the last day for receipt of tenders is Friday next, June 14.

Current Sales of Gas Products

The London Market for Tar Products.

June 8.

The prices of tar products remain steady at the following levels:

Pitch, about 40s. per ton f.o.b.

Creosote, about 5¾d.

Refined tar, 4d. per gallon in bulk at makers' works.

Pure toluole, 2s. 2d. to 2s. 3d.; pure benzole, 1s. 7d. to 1s. 8d.; 95/160 solvent naphtha, 1s. 5d.; and 90/160 pyridines, about 5s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

June 11.

The average prices of gas-works products during the week were: Gas-works tar, 20s. to 25s. Pitch—East Coast, 36s. to 38s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 36s. to 38s.* Toluole, naked, North, 1s. 8d. to 1s. 9d. Coal-tar crude naphtha, in bulk, North, 6¾d. to 7d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 5½d. Heavy naphtha, North, 9¾d. to 10¾d. Creosote, *ex* works, in bulk, North, liquid and salty, 5d. to 5⅛d. ; low gravity, 4¾d. to 5d.; Scotland, 4⅞d. to 5d. Heavy oils, in bulk, North, 4¾d. to 5d. Carbolic acid, 60's, 2s. 1d. to 2s. 2d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *June* 8.

Creosote oil is still commanding considerable attention, but other products are rather quiet.

Crude gas-works tar.—The actual value is 28s. to 30s. per ton *ex* works in bulk.

Pitch.—Values are purely nominal at round 37s. 6d. per ton f.o.b. Glasgow for export and 37s. 6d. per ton *ex* works in bulk for home trade.

Refined tar is available in large quantities, and makers are holding for about 3d. per gallon net and naked at works.

Creosote oil is not plentiful, and available supplies command, without difficulty, the following prices: B.E.S.A. Specification, 5½d. to 5⅝d. per gallon; low gravity, 5¼d. to 5½d. per gallon; and neutral oil 5¼d. to 5½d. per gallon; all f.o.r in bulk.

Cresylic acid.—Very little business is taking place, and quotations are unsteady. Pale, 97/99%, 1s. 1½d. to 1s. 2½d. per gallon; dark, 97/99%, 1s. to 1s. 0½d. per gallon; and pale, 99/100%, 1s. 2½d. to 1s. 3½d. per gallon; all *ex* works naked.

Crude naphtha.—Value shows an increase during the week to 4½d. to 5d. per gallon, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 3½d. to 1s. 4d. per gallon, and 90/190 heavy naphtha is 10½d. to 11½d. per gallon.

Motor benzole is unchanged at 1s. 2½d. to 1s. 3½d. per gallon in bulk at makers' works.

Pyridines.—90/160 grade is 5s. 6d. to 6s. per gallon, and 90/140 grade 6s. to 6s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole . . .	0 9½	to	0 10	per gallon at works
Motor ,, . . .	1 3	,,	1 3½	,, ,, ,,
90% ,, . . .	1 4	,,	1 4½	,, ,, ,,
Pure ,, . . .	1 7½	,,	1 8	,, ,, ,,

Forthcoming Engagements

June.

14.—SOUTHERN ASSOCIATION (WESTERN DISTRICT).—Commercial Meeting, Rougemont Hotel, Exeter, 2.30 p.m.

17.—GAS COMPANIES' PROTECTION ASSOCIATION.—Meeting of the Committee, 2.30 p.m.

19.—ASSOCIATION OF STATUTORY INSPECTORS OF GAS METERS.—Annual General Meeting, County Hall, Westminster, 10.15 a.m.

19.—B.C.G.A.—Meeting of Executive Committee, 11 a.m.

19.—B.G.F.—Meeting of Exhibitions Committee at 28, Grosvenor Gardens, S.W. 1, 2.30 p.m.

20.—I.G.E.—Refractory Materials Joint Committee, Stoke-on-Trent, 2.30 p.m.

20.—S.B.G.I.—Council Meeting, 56, Victoria Street, S.W. 1, at 11 a.m.

21.—NORTH OF ENGLAND (AUXILIARY) ASSOCIATION.—Half-Yearly Meeting at Newcastle-upon-Tyne. Address by Mr. S. A. Wikner.

22.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Summer Visit to Winchester.

25.—SOUTHERN ASSOCIATION.—Visit to Guildford.

26.—I.G.E.—Oral Examinations in Gas Engineering and Gas Supply, Board of Examiners, 9.30 a.m.

28.—WAVERLEY ASSOCIATION.—Annual Meeting in Edinburgh.

British Industries Fair Date Change

Birmingham Section Back to February

Our readers will be interested to learn that after one year's trial of holding the heavy section of the British Industries Fair in May, it has been decided to revert next year to the original dates—to synchronize with the London section. The 1936 Fair, both in London and Castle Bromwich, will be held from Feb. 17 to 28.

In announcing the reversion to the old dates, Mr. J. Percy Plant (Chairman of the Board of Management) stated that the management of the Fair were now of the opinion that the holding of the heavy section of the Fair simultaneously with the London section in February was desirable.

The object of the B.I.F. is, of course, primarily to attract the overseas buyer, and for this reason it is considered that the February date is more suitable for buyers generally, and that the heavy section should run concurrently with the London section in order to avoid a multiplicity of visits to this country by overseas buyers. It is believed that the change of date from February to May of the Birmingham section was due in some measure to representations by a number of heavy section exhibitors —particularly those responsible for the large number of outside displays, for the purpose of which the weather usually associated with February was not regarded as helpful. It is now considered, however, that, having regard to all the circumstances, February is the more suitable month.

NEARLY **300** OF THE WORLD'S GAS UNDERTAKINGS HAVE ADOPTED

THE WEST SYSTEMS

FOR COAL CARBONIZATION AND RELATED PROCESSES

Here are some of the Plants now in hand or recently completed

ST. ALBANS : A battery of Westvertical carbonizing chambers, with complete equipment for coal and coke handling and treatment and for waste-heat utilization, at the works of the Watford and St. Albans Gas Company.

WILLENHALL : A Westvertical carbonizing chamber plant for the Willenhall Gas Company.

TIPTON : Remodelling of a portion of the Glover-West vertical retort plant at the works of the Tipton Urban District Council Gas Department.

NORTH SHORE, SYDNEY, N.S.W. : A complete installation of Westvertical carbonizing chambers to augment the Glover-West vertical retort plant built in 1917 at the works of the North Shore Gas Company of Sydney, New South Wales.

JOHANNESBURG, South Africa : An exact duplicate of the Glover-West vertical retort installation and waste-heat recovery plant which formed the carbonizing unit of the complete new gas works built at Cottesloe in 1928 for the Johannesburg Municipality.

ST. HELENS : An installation of Glover-West vertical retorts of the latest design, with coal and coke-handling machinery and waste-heat recovery plant, for the St. Helens Corporation Gas Department. The first carbonizing unit of Glover-West design to be constructed was installed at St. Helens in 1908, and the present is the fourth contract received from the undertaking.

EXETER : Modernizing of vertical retort beds included in the Glover-West plant at the works of the Exeter Gas Light and Coke Company, for whom five contracts have been carried out.

LEVEN, SCOTLAND : An extension to the installation of Glover-West vertical retorts built in 1926 at the works of the Buckhaven and Leven Gas Commissioners.

SOUTHEND-ON-SEA : A complete Glover-West vertical retort plant with coal and coke-handling and waste-heat recovery equipment at the Southend-on-Sea station of the Gas Light and Coke Company, London.

MANCHESTER : An extension of Glover-West vertical retort plant of modern design with waste-heat recovery equipment, and remodelling of plant of earlier design, at the Manchester Corporation Gas Department's Rochdale Road Works. Five contracts have been received from the Manchester undertaking.

KILSYTH, SCOTLAND : A complete installation of Glover-West vertical retorts at the works of the Kilsyth Corporation Gas Department.

MONTROSE, SCOTLAND : An extension to the Glover-West vertical retort plant built in 1921 for the Montrose Gas Company, Ltd.

BUXTON : A complete installation of Glover-West vertical retorts for the Buxton Corporation Gas Department.

SLOUGH : A complete installation of Glover-West vertical retorts for the Slough Gas and Coke Company.

SVENDBORG, DENMARK : A complete installation of Glover-West vertical retorts for the gas works of the Svendborg Municipality.

CARBONIZING PLANTS RECENTLY PUT INTO OPERATION

ROSKILDE, DENMARK : An extension of Glover-West vertical retorts at the Roskilde Municipal Gas Works.

LEICESTER : Remodelled Glover-West plant, with new coke grading and waste-heat recovery equipment, at the Leicester Corporation's Belgrave Gate Gas Works—the sixth order completed for the Leicester undertaking.

CLEVEDON : The third installation of Glover-West vertical retorts ordered by the Clevedon Gas Company.

YEADON : A complete Glover-West vertical retort plant erected for the Yeadon and Guiseley Gas Company.

BILSTON : A fully-equipped installation of Glover-West vertical retorts at the Works of the Bilston Gas Light and Coke Company.

LLANELLY : A complete Glover-West vertical retort plant at the Works of the Llanelly Gaslight Company.

COAL & COKE-HANDLING AND TREATMENT PLANTS

Orders have been received recently for units at :—

DUMBARTON : For the Dumbarton Corporation Gas Department, Scotland ;

SHEERNESS : For the Sheppy Gas Company (South-Eastern Gas Corporation) ;

STRETFORD : For the Stretford and District Gas Board ;

NEWCASTLE-UPON-TYNE : For the Newcastle-upon-Tyne and Gateshead Gas Company ; and

HARROGATE : For the Harrogate Gas Company.

Units recently put into service include Coke-Handling and Treatment Plants for the Leamington Priors Gas Company, the Elswick Works of the Newcastle-on-Tyne and Gateshead Gas Company and the Romford Gas Company.

GLOVER-WEST VERTICAL RETORTS

WESTVERTICAL CARBONIZING CHAMBERS

BREEZE-BURNING PRODUCERS AND WASTE-HEAT RECOVERY PLANT
MODERN METHODS OF COAL & COKE HANDLING & TREATMENT

WEST'S GAS IMPROVEMENT COMPANY, LTD.

MANCHESTER : Albion Ironworks, Miles Platting. LONDON : Regent House, Kingsway, W.C. 2

STOCK AND SHARE LIST

Official Quotations on the London and Provincial Stock Exchanges

Issue. £	Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, June 7.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,551,868	Stk.	Mar. 11	7	7	Alliance & Dublin Ord. ...	130—140	...	...
374,000	„	Dec. 17	4	4	Do. 4 p.c. Deb. ...	90—100	...	...
557,655	„	Feb. 18	7	7	Barnet Ord. 7 p.c.	165—170	...	168½
300,000	1	Apl. 8	1/4⅜	1.9⅜	Bombay, Ltd.	27/6—29/6	...	...
178,480	Stk.	Feb. 18	9½	9½	Bournemouth sliding scale ...	220—230	...	...
550,050	„	„	7	7	Do. 7 p.c. max. ...	167—172	...	172½
439,160	„	„	6	6	Do. 6 p.c. Pref. ...	147—152	...	152
50,000	„	Dec. 17	3	3	Do. 3 p.c. Deb. ...	86—91	...	...
262,025	„	„	4	4	Do. 4 p.c. Deb. ...	105—110	...	...
335,000	„	„	5	5	Do. 5 p.c. Deb. ...	125—130	...	...
357,900	„	Feb. 18	7½	7½	Brighton, &c., 6 p.c. Con. ...	173—178	...	...
649,955	„	„	6½	6½	Do. 5 p.c. Con. ...	153—158	...	155½—157
205,500	„	„	6	6	Do. 6 p.c. B. Pref.	145—150	...	...
1,487,500	„	Feb. 4	5	5	Bristol, 5 p.c. max.	120—122*a*	−1	..
120,420	„	June 7	4	4	Do. 1st 4 p.c. Deb. ...	100½—102½*a**	−1½	...
217,870	„	„	4	4	Do. 2nd 4 p.c. Deb. ...	100½—102½*a**	−1½	...
328,790	„	„	5	5	Do. 5 p.c. Deb.	120—122*a**	−2	...
855,000	„	Mar. 11	7	8	British Ord.	155—160	...	...
100,000	„	June 7	7	7	Do. 7 p.c. Pref.	160—165*	...	162
350,000	„	„	5½	5½	Do. 5½ p.c. "B" Cum. Pref.	112—117*	−2	...
120,000	„	„	4	4	Do. 4 p.c. Red. Deb. ...	95—100*	−2	...
450,000	„	„	5	5	Do. 5 p.c. Red. Deb. ...	109—114*	−2	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1—3	...	...
100,000	10	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1—3	...	...
150,000	Stk.	Dec. 17	4½	4½	Do. 4½ p.c. Deb. ...	85—90	...	...
626,860	„	Jan. 21	6	6	Cardiff Con. Ord.	130—135	...	...
237,860	„	June 7	5	5	Do. 5 p.c. Red. Deb.	103—108*	−2	...
157,150	„	Feb. 4	5	6½	Chester 5 p.c. Ord.	11⅝—12⅞	...	...
98,936	1	Mar. 25	2/-	2/-	Colombo, Ltd., Ord.	1—3	...	...
24,500	1	„	1/4½	1/4½	Do. 7 p.c. Pref. ...	20/6—22/6	...	...
609,204	1	Mar. 25	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	20/6—22/6	...	...
296,053	1	„	1/3·30	1/3·30	Do. 8 p.c. Pref.	26/—28/-	...	...
1,775,005	Stk	Feb. 4	5	6	Commercial Ord.	105—110	−2	106—107
475,000	„	June 7	3	3	Do. 3 p.c. Deb. ...	85—90*	...	88⅛
286,344	„	Feb. 18	5	5	Do. 5 p.c. Deb. ...	123—128	...	...
807,560	„	Feb. 18	7	7	Croydon sliding scale... ...	155—160	...	157
569,590	„	„	5	5	Do. max. div.	112—117	...	115—115½
620,385	„	Dec. 17	5	5	Do. 5 p.c. Deb.	125—130	...	...
542,270	„	Feb. 18	7	10	Derby Con.	185—195*c*	...	...
55,000	„	Dec. 17	4	4	Do. 4 p.c. Deb.	100—105*c*	...	...
239,000	„	Feb. 4	5	5	East Hull Ord. 5 p.c. ...	108—113	...	...
181,625	„	Feb. 4	6	6	East Surrey Ord 5 p.c. ...	131—136	...	134½
175,609	„	June 7	5	5	Do. 5 p.c. Deb. ...	118—123*	−2	...
1,002,180	„	Mar. 11	†	†7	European, Ltd.	120—130	+10½	116—127
19,313,481	„	Feb. 4	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	27/3—28/3*f*	...	27/9—28/-
2,600,000	„	„	3⅜	3⅜	Do. 3½ p.c. max. ...	85—90	...	89
4,477,106	„	„	4	4	Do. 4 p.c. Con. Pref. ...	104—109	...	107½—109
6,102,497	„	June 7	3	3	Do. 3 p.c. Con. Deb. ...	87—92*	−1	87½—90½
3,642,770	„	„	5	5	Do. 5 p.c. Red. Deb. ...	113—118*	−2	116½—117½
3,500,000	„	„	4½	4½	Do. 4½ p.c. Red. Deb. ...	109—114*	−2	...
270,466	„	Feb. 18	6	6	Harrogate New Cons. ...	135—140	...	...
140,000	1	Mar. 25	1/7½	1/7½	Hongkong & China, Ltd. ...	1½—1½	...	27/9—28/-
213,200	Stk.	Feb. 18	6	6	Hornsey Con. 3½ p.c.... ...	128—138	...	...
5,600,000	„	May 13	10	14	Imperial Continental Cap. ...	207—217	+7	207—212½
223,130	„	Jan. 21	3½	3½	Do. 3½ p.c. Red. Debs.	91—96	...	94
285,242	„	Feb. 18	8½	8½	Lea Bridge 5 p.c. Ord. ...	175—185	...	...
2,167,410	„	Feb. 18	6	6	Liverpool 5 p.c. Ord.... ...	136—140*b*	−4	...
245,500	„	Dec. 17	5	5	Do. 5 p.c. Red. Pref. ...	105—110*b*	...	...
306,083	„	Jan. 16	4	4	Do. 4 p.c. Deb.	104—107*b*	...	...
165,736	„	Feb. 18	8	10	Maidstone 5 p.c. Cap. ...	185—195	...	...
63,480	„	Dec. 17	3	3	Do. 3 p.c. Deb. ...	83—88	...	...
75,000	„	May 27	†10	†10	Malta & Mediterranean ...	210—220*	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	100—105	...	...
231,978	Stk.	Feb. 4	5	5	M. S. Utility "C" Cons. ...	110—115	...	...
818,657	„	„	4	4	Do. 4 p.c. Cons. Pref.	102—107	...	105½
360,075	„	Dec. 17	4	4	Do. 4 p.c. Deb. ...	103—108	...	...
148,955	„	„	5	†5	Do. 5 p.c. Deb.	125—130	...	...
125,000	—	Jan. 2	11/8	3⅛	Do. 3½ p.c. Rd. Rg. Bds.	99—102	...	...
675,000	„	28 May '34	†6	††3	Montevideo, Ltd.	50—60	...	50—50½
2,061,315	„	Feb. 18	5	5⅔	Newcastle & Gateshead Con.	25/9—26/9*df*	—/6	...
682,856	„	„	4	4	Do. 4 p.c. Pref. ...	106—107*d*	...	...
776,706	„	June 7	3½	3½	Do. 3½ p.c. Deb. ...	101½—102½*d**	...	...
277,285	„	Oct. 8	5	5	Do. 5 p.c. Deb. '43 ...	105—107*d*	...	...
274,000	„	Feb. 4	5	5	Newport (Mon.) 5 p.c. max....	115—120*a*	...	...
225,000	„	Feb. 18	7½	7½	North Middlesex 6 p.c. Con.	165—175	...	...
396,160	„	Feb. 4	5	5	Northampton 5 p.c. max. ...	105—110	...	...
300,000	„	Apl. 29	†9	†7	Oriental, Ltd.	167—172	...	...
416,617	„	June 7	8	8	Plym'th & Stonehouse 5 p.c.	162—167*	−3	168½
504,416	„	Feb. 4	8	8½	Portsm'th Con. Stk. 4 p.c. Std.	175—180	...	...
241,446	„	„	5	5	Do. 5 p.c. max. ...	110—115	...	...
114,000	„	Jan. 21	5	5	Preston 5 p.c. Pref.	108—113	...	...
1,736,968	Stk.	Feb. 18	6	6	Sheffield Cons.	142—144*e*	...	...
95,000	„	Jan. 7	4	4	Do. 4 p.c. Deb.	103—106*e*	...	...
133,201	„	Feb. 18	8⅓	5	Shrewsbury 5 p.c. Ord. ...	142—147	...	142
90,000	10	May 27	‡3	‡3⅓	South African	3—4*	...	3⅓
1,061,779	1	May 13	1/2⅛	1/2⅛	South East'n Gas Cn. Ld. Ord.	27/—29/-	...	27/9
845,016	1	Mar. 11	-/10⅛	-/10⅛	Do. 4½ p.c. Red. Cum. Pref.	22/—23/-	...	22/6—22/11½
450,000	Stk.	Feb. 4	74/4	4	Do. 4 p.c. Red. Deb. ...	100—103	...	...
6,709,895	„	Feb. 4	5	6½	South Met. Ord.	130—135	...	129—131½
1,135,812	„	„	6	6	Do. 6 p.c. Irrad. Pf. ...	147—152	...	149½
850,000	„	„	4	4	Do. 4 p.c. Irrad. Pf. ...	104—109	...	107
1,895,445	„	Dec. 17	3	3	Do. 3 p.c. Deb. ...	87—92	...	89—90
1,000,000	„	Jan. 7	5	5	Do. 5 p.c. Red. Deb....	113—118	...	...
209,820	„	Feb. 18	8½	8½	South Shields Con.	174—176*d*	...	...
1,543,795	„	Feb. 18	6	6	South Suburban Ord 5 p.c. ...	130—135	...	130—132
512,825	„	„	5	5	Do. 5 p.c. Pref. ...	121—126	...	122½
500,000	„	„	4	4	Do. 4 p.c. Pref. ...	105—110	+3	108½—109
888,587	„	June 7	5	5	Do. 5 p.c. Deb. ...	122—127*	−2	126½—128
250,000	„	„	4	4	Do. 4 p.c. Deb. ...	102—107*	−1	...
647,740	„	Feb. 4	5	5	Southampt'n Ord. 5 p.c. max.	114—119	...	120
121,275	„	June 7	4	4	Do. 4 p.c. Deb.	100—105*	−2	...
350,000	„	Feb. 4	5½	5½	Swansea 5½ p.c. Red. Pref. ...	115—120	...	...
200,000	„	June 7	6½	6½	Do. 6½ p.c. Red. Deb. ...	98—103*	−2	...
1,076,490	„	Feb. 18	6½	6½	Tottenham and District Ord.	148—153	...	148½—150½
409,835	„	„	5½	5½	Do. 5½ p.c. Pref. ...	131—136	...	133—135
62,235	„	„	5	5	Do. 5 p.c. Pref. ...	120—125	...	120
199,005	„	June 7	4	4	Do. 4 p.c. Deb. ...	101—106*	−2	105
369,774	„	Feb. 4	7	7	Uxbridge, &c., 5 p.c. ...	150—155	...	...
108,330	„	„	5	5	Do. 5 p.c. Pref. ...	118—123	...	...
1,326,700	„	Feb. 4	7	7	Wandsworth Consolidated ...	155—160	...	156—158
1,371,373	„	„	5	5	Do. 5 p.c. Pref. ...	121—126	...	...
1,317,964	„	June 7	5	5	Do. 5 p.c. Deb. ...	124—129*	−2	...
208,300	„	„	26/8	4	Do. 4 p.c. Deb. ...	102—107*	−2	...
158,400	„	Feb. 18	5	6*g*	Winchester W. & G. 5 p.c. Con.	116—121	...	...

Quotations at :—*a*.—Bristol. *b*.—Liverpool. *c*.—Nottingham. *d*.—Newcastle. *e*.—Sheffield. *f*.—The quotation is per £1 of Stock. *g*.—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

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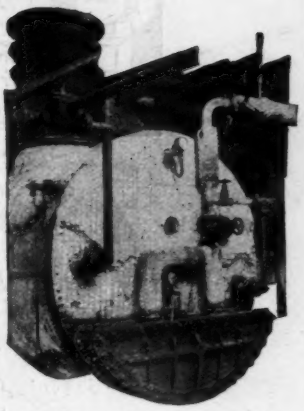

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